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Training & Transfer of Money Skills using Computer Aided Learning

by

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Abstract

Deinstitutionalisation has resulted in a growing number of people with intellectual handicaps living in the community. For this reason, it is increasingly important to develop effective training programs to enable them to make use of community facilities, and to avoid being taken advantage of. An important community living skill is the ability to handle money, and this study set out to teach these skills, using computer assisted learning, to five people with mild and moderate intellectual handicaps. Earlier studies have addressed this issue, but have not tested whether the skills so acquired can be applied in real purchasing situations. This study evaluated subjects using a single subject multiple probe design across tasks.

Subjects were taught four tasks using a computer assisted learning system: to give the correct coins for one coin, simple two coin, complex two coin and three coin prices. The system was designed similarly to two previous studies and adopted behavioural and educational instructional techniques to encourage transfer.

Results show that all subjects were able to perform each of these tasks to criterion on the CAL system under three different prompt conditions. The subjects transferred the skills learnt to a simulated transaction, yet were unable to transfer these skills (apart from the one coin problems) consistently to the real world. Two subjects appeared to exhibit partial transfer, yet no conclusive inferences could be made.

This study discusses the reasons for the lack of transfer of money skills to actual purchasing situations, and suggests that future research could look more closely at some of the assumptions of computer assisted learning and explore ways to enhance the generalisability of acquired skills.

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Table of Contents

Appendices

Tables

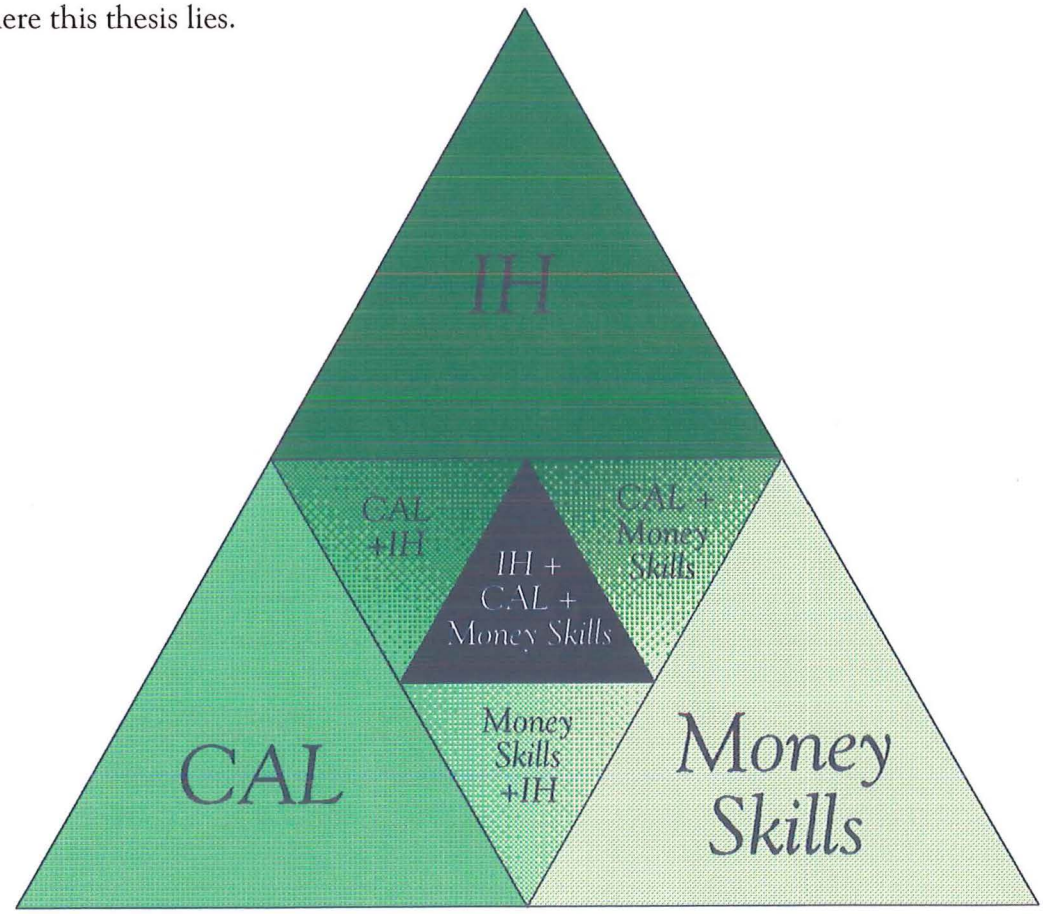
Figures

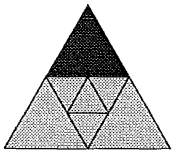
Introduction

The process of deinstitutionalisation is in its third decade, and community based instruction of life-skills is becoming an increasingly important component of educational programs for persons with an intellectual handicap. There are many different teaching methods and techniques which could be employed to teach community skills. There are also numerous skills which could be taught. An important criterion for much of the success an instructional program is that the skills taught should be able to be successfully transferred to real world situations.

This study examines whether people with intellectual handicaps can apply money skills to actual purchasing situations when they are taught using computer assisted learning.

The introduction discusses the nature and significance of intellectual handicaps, computer assisted learning and money skills, and then the way that they way that they relate to each other. The triangle in *figure 1-1* provides a graphical representation of the structure of the introduction, which takes a spiral path into the core of the issue, where this thesis lies.





1.1 Intellectual Handicap

1.1.1 Deinstitutionalisation

The history, treatment and consequent place of residence of people who are intellectually handicapped (IH) varies from culture to culture, and from person to person. At times they have been labelled with negative titles such as 'possessed', and at other times have been respected and well treated. However the prevalent notion was, until recently, that moral and mental defectiveness were linked, and people who are IH were often regarded as a menace to society; as people who should be isolated from the community in institutions, preferably in rural areas (Craig & McCarver, 1984). "For intellectually handicapped people two hundred years ago, institutions were laudable options to witch-hunts, casting out, cruelties and segregation" (Webb, 1986, p. 90).

Within the last twenty to thirty years the notion of 'normalisation' for persons who are IH has come into prominence. The normalisation principle was espoused by Wolfensberger (1972) who stated that institutions should fade away and be replaced by small community residences because they were more normal (Craig et al., 1984). He defined normalisation as "the utilisation of means which were as culturally normative as possible in order to establish or maintain personal behaviour or characteristics which are as culturally normative as possible" (cited by Tiong, 1989, p. 1). By the mid 1960's there was an international acceptance of the superiority of community care over institutional care (Jack, 1986). These changes in the attitudes towards the needs and subsequent care of people with IH have taken place against a broad social backdrop " — awareness of the negative effects of institutionalisation, consumerism, minority group consciousness and activism, the growth of patients' rights groups, challenges to medical imperialism and the development of community mental health ideology" (Abbott, 1986, cited by, Howie & Cunning, 1986, p iii).

As a result, traditional forms of care in hospitals and large institutions have come under criticism as not being in the best interests of many people who are IH (Morrison, Beasley & Williamson, 1976). Today concerned professionals seek to promote "deinstitutionalisation" rather than "institutionalisation". In recent years it has been widely acknowledged that persons with IH have a right to live within the mainstream of life. "Increasingly, new admissions of young intellectually handicapped people to

hospitals are for short- rather than long-term stay, and are intended for assessment or for the relief of carers" (Craig & Mills, 1987, p. 32). That is, "over the last decade overall prevalence has changed little, but hospital provision, especially for children, has dramatically reduced" (Yule & Carr, 1987, p. 1). This movement reflects integration rather than segregation—attempted normalisation.

Community care requires that the place of residence be "as homelike a setting as possible" (Jack, 1986, p. 85). Community care involves the transfer of resources from the institution to the community facilitates, and requires that the community offer a full range of services (Jack, 1986).

One problem with the concept of 'community care' is that it covers a broad spectrum of supervision, including clients under total care, partial supervision, or living independently. In order to help people adapt to this environment, institutions, group homes and numerous other facilities are training clients in community living skills. "With the shift to community living, the mentally handicapped person becomes the consumer of an individualised set of services. How well these services serve him [or her] depends on the provisions and safeguards now in the making" (Nihira & Nihira, 1975, p. 543). This transition has often been costly, and funding has been moved from health into social services (Yule et al., 1987). However, in the long term this movement from institutions into the community is cost effective for the clients and society (Martin, O'Toole, Touchette, Berger, & Doyle, 1979).

Whether institutions will continue to fade away depends largely on the resources allocated to community support services, because "to function competently within community settings of varying complexity, individuals must demonstrate a wide array of skills" (Close, Irvin, Taylor, & Agosta, 1981, p.76).

New Zealand follows this same international trend towards deinstitutionalisation. *Section 1.3* examines this and other national issues more closely, to describe the context within which this research has taken place.

1.1.2 Definition

It is important to define the term intellectual handicap (IH), and to have some knowledge of the numbers and differing characteristics of people who are IH. This definition is important for the following reasons:

- The term intellectual handicap is difficult to define and the multiplicity of thresholds that researchers have defined mean that studies are difficult to compare. For example, some research has simply relied on intelligence tests to determine if a person is intellectually handicapped, whereas others use a battery of tests. Until all research can be related to some benchmark of intellectual handicap, it is difficult to draw conclusions from the research available.
- The nature of the intellectual handicap influences the mode of treatment or teaching method employed. If the person is deemed severely handicapped, then the approach might differ from that used for a mildly handicapped individual.

Definitions of intellectual handicap have undergone numerous changes, with the same behaviour being deemed appropriate, inappropriate, or even ridiculous in different ages and cultures. In some cultures people who were IH were put to death because of their 'deficiencies'. Today such an action would be considered criminal in most countries. Changes in attitudes have evolved with subsequent cultures, over a long period of time, influenced by great social, industrial and religious upheaval. The terminology used reflects the changing positions of different societies. "In different countries, including our own, and at different times, the terms 'mental deficiency', 'mental subnormality', 'mental handicap', 'mental retardation', have all been used according to changing concepts" (Morrison, Beasley & Williamson, 1976, p. 2). The way that people are classified is important; this influences who is included and who is excluded in research. There are 2600 published psychological tests that measure a range of mental abilities and behavioural traits (Weiten, 1992). For the purposes of this research the term intellectual handicap (IH) will be used, as it is a widely used term in New Zealand.

"As recently as 1973 the Royal Commission of Inquiry in Hospital and Related Services, a landmark commission in New Zealand, stated: "the distinction between the mentally handicapped and the mentally ill has been blurred—and often forgotten" (Howie et al., 1986, p. 14). An IH person *is not* sick, rather disabled (New Zealand Planning Group, 1987). It is not like an illness for which a cure can be found to heal the person. It can be congenital, but some people with IH become this way through an

accident or illness. However it comes about, it is usually irreversible. IH is a label that describes a person's position relative to other people, based on some standard of performance.

Western civilisations have traditionally tended to rely, as for many things, on the judicial and church systems to define IH. The majority of early research into the prevalence of IH relied mainly on the legal definition of what was then called 'mental deficiency'. The church and the judicial definitions both relied heavily on social and behavioural criteria to group people (Morrison et al., 1976). Today, one of the primary criterion used for defining a person with IH is *intelligence* (Weiten, 1992). This criterion is based on four intelligence quotient (IQ) ranges: 70-84 (borderline), 50-70 (mild), 35-50 (moderate), 20-35 (severe) below 25 (profound) (Weiten, 1992). This means of classification is still highly regarded today.

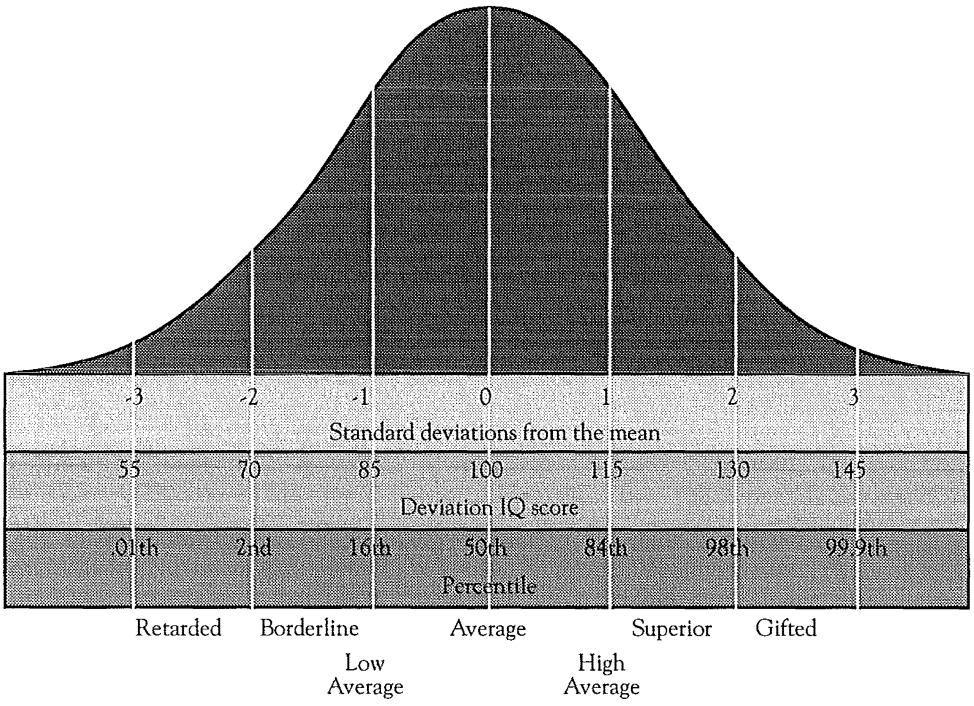


Figure 1-2: Normal Distribution Curve (Bell Curve)

IQs are based on a normal distribution curve (*Figure 1-1*); the higher the curve, the greater the number of people with IQs at that level. An average IQ is defined to be 100. Most people have an IQ between 85 and 115 (about 2/3 of the population). 29% of the population is between 70 and 85, and between 115 and 130. An IQ of 70 is considered the critical score when classifying people as IH; it is considered the cut-off point *if* a person also has impaired adaptive behaviour (Weiten, 1992).

Theoretically, 2.3% of the population should be classified as being IH, without taking adaptive behaviour into account. Taking adaptive behaviour into account, less than 2.3% of the population would be considered IH.

To illustrate, it is widely accepted that many of the 'standard' IQ tests (such as Wechsler Intelligence Scale for Children — WISC) are not suitable for minority groups (such as Maori and Polynesian), as they tend to have an ethnocentric bias against these groups, in particular linguistically (Yussen and Santrock, 1982). Social and economic factors, as well as the competence of the tester, can influence results of tests. Taking adaptive behaviour into account is a powerful influence as "this stresses potential for changes in learning and behaviour, thus removing the static descriptions of intelligence such as IQ and MA [mental age]" (Ryba, 1980, p.2). There are specific diagnostic tools used to assess adaptive behaviour: such as the "Adaptive Function Index" (Marlett, 1973, cited by Ryba, 1980, p. 2).

There are numerous other variables that may also influence the severity of the handicap, such as knowledge and attitude of the family, medical practitioners, hospital staff, and the quality of care after birth. The most severe forms are often congenital and may be identified at, or relatively soon after birth (Craig et al., 1987). The less severe forms of intellectual handicap may not become evident until the person is subjected to increasing intellectual demands, often when they start school (Morrison et al., 1976). Therefore, an IQ score may reflect an individuals *current* performance but it does not always indicate their academic *potential* (Weiten, 1992).

In conclusion, IQ alone is not a good predictor of the number in a population with IH; social factors are also important. The consequences and significance of an intellectual handicap for a person's ability to participate in society, and their capacity for self-care, is the result of both social and environmental factors, as well as the person's intellectual ability.

1.1.3 *The New Zealand Scene*

Effective programs to help people with IH and their families depend upon information about the group of people who need those services. Regardless of the broad agreement there may be about the services required for people with IH , "no systematic planning of these services can begin without knowledge of the retarded, their differing characteristics and their differing requirements" (Morrison et al., 1976, p. 1). This information should include:

- the number of people
- localities where they live
- distribution of age and sex
- levels of disability
- causes of disability
- descriptions of the services utilised

Some of these will be presented in this section. It was found that obtaining national statistics on the intellectually handicapped was difficult. The New Zealand Census does not collate such information about this group, nor does the New Zealand Society for the Intellectually Handicapped Inc. (IHC).

1.1.3.1 Numbers of people with IH in New Zealand

Statistics from the IHC in June 1992, estimate that there are 11,000 people with an intellectual handicap in New Zealand. Interestingly, numbers have actually increased throughout this century, and are projected to continue to increase. This change has been "attributed to improvements in survey methods and also in the influence of continuing technological developments within various countries" (Morrison, et al., 1976, p. 29). Increasing technology demands higher levels of adaptive behaviour for acceptable vocational and personal adjustment.

1.1.3.2 Where they do they live?

Numerous community homes exist for people who are IH. Between 1971 and 1981 there was a 11% drop (from 4 329 to 3 850) in the number of people with IH living in institutions in New Zealand (N.Z. Department of Health, 1983, cited by Jack, 1986, p. 87). The data also shows that there were fewer new admissions to psychiatric hospitals. The percentage of IH living in their family home has also decreased, adding to the increase in community care (Craig et al., 1987).

A separate survey in 1971 indicated that 40% of New Zealand's people with IH were in either psychiatric or psychopeadic hospitals (Morrison et al. 1976). 1990 data

indicates that only 20% of people who are IH in New Zealand were residing within institutions; a significant drop (see *Table 1-1*). More recently, the closure of hospitals such as Tokanui in the Waikato region has continued this trend. "In other words New Zealand has moved to a point where treatment in the community (in most cases) is the preferred option to treatment in hospital" (Atawhaitia, 1991, p. 19).

Residential Status of people with IH in New Zealand	1990	1990
With families in their own home	5,300	48%
IHC Homes	3,000	27%
Institutional Care	2,200	20%
Living with other agencies (independent)	309	3%
In Hopepa Homes	150	1.5%.
Mt Tabor Trust Homes	41	0.5%
Total	11,000	100%

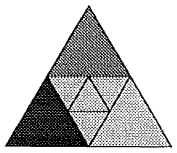
(**Source:** *Total Current Estimation, from a report of the IHC Review Working Party, 1990, Appendix 1).*

Table 1-1: Residential Status of Intellectually Handicapped in New Zealand

However, "by international standards we [New Zealand] have an exceptionally high number of people with intellectual handicaps in hospital" (Capie, 1986, p. 94). He cites Queensland, Australia whose population is similar to New Zealand but has less than 700 people with intellectual handicaps in hospital care.

There have been numerous groups in New Zealand who have tried to get as many people with IH as are able to live in the community. The most prominent of these groups in New Zealand is the IHC. "In 1973 they accommodated approximately 500 persons; in 1985 the figure was approximately 2 500. Had this care not been available it is probable that many of these people would now be in psychiatric hospitals" (Jack, 1986, p. 85).

Given that deinstitutionalisation is a reality, people who are IH need training in community living skills. *Section 1:6* argues that money is an important part of community life, and it is worthwhile to train people with IH skills in money use. The next section looks at Computer Assisted Learning, one candidate teaching technique, and the technique used in this study.



1.2 Computer Assisted Learning

"Once a new technology rolls over you; if you're not part of the steamroller, you're part of the road"

(Brand, 1987, p. 9)

This section discusses computers: their evolution, their potential, their role as educators, their advantages over, similarities to, and disadvantages with respect to traditional teaching methods.

1.2.1 Terminology

In order to aid understanding throughout this thesis, some computing terms will be defined:

Hardware The physical machinery that constitutes the computer. This includes the physical, electronic, and electromechanical parts of the device such as the screen, processor, and keyboard.

Software The computer programs which direct the operation of the hardware.

Courseware A subset of software programs which direct the delivery of instruction (Criswell & Swezey, 1984). Another is all instructional material which accompanies the device.

The software, hardware and courseware together determine the limits of the computer system's operation (Yussen et al., 1982).

1.2.2 A brief history of the computer

"First look backward in order to look forward"

(Thomas J. Watson, Sr., founder of IBM, cited by Williams, 1985, p. ix)

This section briefly describes development of educational technology.

"Pressey of Ohio State University is the doyen of teaching machines for he first advocated their use in the 1920's" (Kay, Dodd & Sime, 1968, p. 41). He made an electromechanical machine designed for the administration of examinations in multiple choice format (Ryba, 1980). In fact, these machines helped the people taking the test to learn. Due to economic pressures of the time, these early teaching machines did not continue or reach common application. The first teaching machines that

gained popularity and acceptance were those that are associated with the work of Skinner and his colleagues during the early 1950's. "The reason for this technological lag seems understandable enough in view of the background of psychological theory of the day which had not yet come to grips with the learning process" (Ryba, 1980, p. 41). Skinner's programmed instruction was based on his work on operant conditioning and the extent to which behavioural principles could be employed in educational environments (Kay et al., 1968). The emphasis was placed on the individual learner and learning was "broken into small steps, with each step calling for the learner to make an overt response" (Yussen et. al., 1982, p. 135). Skinner noted numerous advantages in these teaching devices including "immediate reinforcement for correct responses, active participation in learning through manipulation of the machine, and self-pacing instruction" (Ryba, 1980, p. 35). Ryba (1980) also states that "Skinner stressed the need for technological innovations to provide an active learning environment for the student" (p. 40). The premise behind this argument was that learners were often the passive recipients of information in the context of a 'regular' classroom. "His solution represents the first complete programmed system and is a landmark" (Kay, et al., 1968, p. 43).

"Like so many of our modern interventions, a teaching machine on its own is neither good nor bad. It needs detailed instructions" (Kay, et al., 1968, p. 13). It was important then, as it is now, to gather together teachers, learners and subject matter and program a system to meet specific educational needs. These early teaching machines usually took two forms—linear or branching programs. With linear programs the students tended to have more control, whereas the branching machine gave the system more control.

In 1950 IBM put on the market the first electronic computing machine (Wenborn, 1989). These first computers were large and expensive. In these early years most people rarely heard the word 'computer', and when they did they thought of math geniuses, large organisations, and $100,000 dollar price tags. The computer's commercial and industrial uses affected ordinary people, but very few expected computers to become an integral part of day-to-day living.

As the years went by computers became smaller, and at the end of 1970s, the personal desktop computer was available. This opened up the world of computers to many more people. "Computing power dispersed. It went from the middle to the edges, from broadcaster toward broadcatcher. Thanks to the deliberate grass-roots revolt of the creators of personal computers and the lavish cleverness of the makers of consumer

electronics, the bit business began to be taken over by citizens and customers" (Brand, 1987, p. 43).

Along with the dispersal of computers, they also became more flexible. It is important to recognise that these early machines were very rigid, "with very little flexibility for altering the presentation of stimuli or mode of input required from the learner" (Ryba, 1980, p. 45). Today the computer has become an 'appliance', similarly priced to some televisions, and can be found in many homes throughout the world. Some believe that the microcomputer will become an integral part of *every* household, just as the television has, and that in the classroom, they will be as commonplace as the blackboard. "Computers are an exciting and inescapable feature of modern life, and they are becoming more exciting and more inescapable all of the time"(Budhoff, Thorman, & Gras, 1984, p. 2).

The development of computer technology has moved us from the industrial age into the information age. Like the invention of the motor car or steam engine, computers have now changed the way in which many people approach the world. There is of course some resistance from people, just as there was with the invention of the car and steam engine, as new technology can be overwhelming and intimidating.

Current developments include: integration with video/audio systems and home appliances, improvement of communications networks, and improvements in user interfaces. The growth of such technology means that it is much easier and cheaper to access information through the computer and simple economics drives this technology forward. The grand design of computers keeps getting grander.

Developments in the not too distant future include the computer becoming even more 'friendly', speech input and output, and the development of 'virtual reality'. These developments are assisted by advances in performance and memory capacity, which are currently doubling every two years.

Over the past two decades much research has been undertaken on the effectiveness of using the personal computer in computer assisted learning (CAL). In the early days of Skinner, "the rigidity imposed through machine design meant that educational programmers or teachers had to be resourceful in creating relevant programs that would fit the capability of the machine" (Ryba, 1980, p. 45). During the early years of desktop computers, most were used for word processing, accounting, entertainment, electronic mail, shopping, and even banking. Very few talked about using the

computer as a teaching device. Computer-assisted instruction offers potential but too frequently serves mainly as an information display system (Mitchell, 1988).

1.2.3 *What is CAL?*

CAL[1] is instruction using a computer rather than a human teacher.

People have different views of the role that CAL should have. Papert (1980) wrote that "in many schools today, the phrase 'computer assisted instruction' means making the computer teach the child. One might say that the computer is being used to program the child. In my vision the child programs the computer" (p. 5). However, most CAL still involves the computer taking control rather than the student.

CAL can adopt numerous forms—including simulation, tutorial, and drill-and-practice programs. These are defined below:

Simulation "The simulation mode is particularly useful for replicating problem situations and providing experiences that might otherwise not be available to the learner" (Ryba, 1980, p. 49). For example, simulated flight training.

Tutorial This is when the learner is provided with a complete sequence of instruction under control of the computer. "It is characterised by presentation of the learning material in small units, test items for analysis by the student, and evaluation of student responses to determine feedback and branching routines" (Ryba, 1980, p. 49).

Drill-&-Practice This teaching technique, typically, requires little coding on the part of the learner, due to "essentially involving repetition, practice and remediation in specific areas of study" (Ryba, 1980, p. 49). It involves the generation of a problem by the CAL system, input by the learner using CAL hardware, and feedback as to whether the answer was correct or not. "Common applications of this mode are in areas of arithmetic and language arts" (Ryba, 1980, p. 49).

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1 In the United States it is referred to as computer assisted instruction (CAI) (Ryba, 1980). In this study the term CAL is synonymous with CAI.

CAL involves supplementing or even replacing the traditional teacher with a computer, and can take place in numerous teaching situations, across a wide range of people, from children to adults, from learners who are IH to those who are gifted.

Nowadays CAL is usually designed around a personal computer. For CAL "a satisfactory interface must be portable, in order to take CAL to the learner in his [or her] customary learning environment; it must be reliable, in order to promote credibility in the system; and it must be flexible, in order to take advantage of new input and output devices such as they are required and become available" (Brebner & Hallworth, 1980, pp. 2-3). The precise configuration of the system (hardware and software) is determined by many things such as its use and the number of special features available (eg. speech or animation). CAL programs tend to "recognise that learning is an active process and that students learn best by 'doing, interacting, and exploring, rather than watching and/or listening' " (Davidson, 1989, p. 5; cited by Curzon & Campell, 1992, p. 226).

1.2.3.1 Assessing CAL's Effectiveness

Summaries of CAL research show that it results in equal or better achievement in less time and with more positive student attitudes than traditional instruction (Bass, Ries & Sharpe, 1986).

However, it is thought by some researchers that "as this new wave in educational technology is running high, it is clear that we do not yet have adequate validated empirical evidence in support of the effectiveness of microcomputers as a teaching and learning tool" (Chiang, 1986, p. 118). This is a concern for many reasons.

Most studies in CAL before 1980 concentrated on the use of mainframe computers (very large and expensive computers), but this is no longer the case. There are differences between large mainframe computers and the microcomputer, and comparing studies of CAL's effectiveness without acknowledging these differences is problematic. For example, the personal computer is often in a 'natural' environment, with all of the distractions this may involve, while mainframe use is often confined to the contrived environment of a University laboratory.

Also, as technology is advancing at such a rapid pace, technology may vary markedly between different research studies—"the dynamic and evolving nature of microcomputer technology leaves many questions unresolved" (Budhoff et al., 1984, pp. 3-4).

However, educational design is an iterative process of trial and error. "The point is that development in education has not historically followed research (R&D models are a recent phenomena themselves anyway) and any over rigid requirement that it should may be tantamount to killing off many reforming ideas" (Hooper, 1990, p. 4). Historically when looking at many household materials, development actually preceded research. Hooper goes on to say, "the point is that over-enthusiasm in clarifying what is to be done, in stating objectives and defining audience, may reduce the unpredictability which I believe to be an essential component of education" (Hooper, 1990, p. 10).

Lai (1992) stated that "unlike many technologies used in education in the past such as television (which faded away in a short period of time) my prediction is that the computer will stay in education for a long time to come" (p. 9). The potential of CAL is enormous. Therefore, it is important to emphasise the complexity of issues when developing and disseminating educational tools such as CAL. Although CAL has produced mixed results most have established that such systems do have a place in the curriculum (Kraus, 1981). Much of the research on CAL effectiveness points out that it is often at least as effective as traditional methods (Jordan, 1981). "It is important to realise both the strengths and limitations of current computer technology to be able to put it to use" (Curzon et al., 1992, p. 221). The next section looks at some of the advantages, similarities and disadvantages over traditional teaching.

It is important to keep in mind when reading the following comparisons both techniques are subject to differences in effectiveness, depending on variables such as the age and intelligence of the learner, motivation, teacher-pupil ratios, educational context, learning theory used and so forth. This section describes some general principles which relate to each teaching method as a whole.

1.2.4 *Advantages over Traditional Methods*

"We have already seen the arrival of personal computers make multitudes broader in their skills and interests, less passive, less traditionally role-bound. That's renaissance."
(Brand, 1987, p. 252)

CAL has advantages over traditional methods of teaching:

- Cost effectiveness
- Consistency
- Time flexibility
- Objective recording of interactions

1.2.4.1 Cost Effectiveness:

"The educational technologist's task now is to choose which of the many media available are best in a cost-effective sense at handling particular objectives, on the basic assumption that all media can, technologically, handle all content"
(Hooper, 1990, p. 9).

Cost is an important consideration in education today, and CAL can significantly reduce costs. The initial costs of purchasing both computer hardware and software can be large, but once this initial outlay has been made, running costs are minimal. The computer can be used at any time. Many studies have indicated that CAL is more cost effective than conventional methods. Jordan (1981) found that CAL was cost effective based " on the cost of the system amortised over a 3-year period as compared to the cost of an aide administering a similar paper and pencil program" (p. 266). Since 1981, the ratio of price to performance has decreased by a factor of 30. The cost of the CAL system used in this study is presently (1992-1993) $3000. Also, not only does the resulting hardware continue to get more powerful, but, because it is electronic and very conducive to mass production, it continues to cost less (Jordan, 1981).

1.2.4.2 Consistency:

Computer hardware and software is inherently deterministic. Hardware reacts predicably in response to well-defined inputs, and is not affected by moods or emotion. CAL software if carefully designed and programmed can avoid prejudice by gender or race, age or intellect, which are important issues in education today. CAL has the potential to be infinitely patient, and not to show anger. When programmed correctly, computers are also less prone to error than humans. They can create a non-

threatening environment where the student may make mistakes without embarrassment.

1.2.4.3 Flexibility:

"The flexibility this technology offers is almost unlimited"
(Jordan, 1981, p. 268)

Time

Computers can be used constantly without loss of performance. A computer's availability is therefore higher than that of a human teacher, which means that pupils can study when it most suits them, and when they are most receptive. This give more control of the learning process to the pupil.

Versatility

"The power and versatility of the computer makes it possible for study and learning opportunities to be extended to many more people, over longer periods of time, in both formal and non-formal situations, including the privacy of one's own home" (Hodson, 1992, p. 45). This helps bring education to people who may otherwise miss out without such technology.

1.2.4.4 Objective recording of interactions:

Courseware can be written to provide objective evaluation of performance. This eliminates observer bias and errors in evaluation. Computers excel at evaluation procedures that humans find tedious, and can produce extremely accurate timings. That is, "the computer can, if so programmed, provide a very rich record of student interaction — the conventional tutorial provides no such record of itself" (Hooper, 1990, p. 5).

Given such an analysis of a student's performance, human assistance can be directed to appropriate students, and to particular subjects for each person. Through monitoring and recording its own activity, the system can also be tuned, based on the computational analysis (statistical or otherwise) of the session logs. Teachers are unable to keep track of their own performance as easily and objectively; usually their evaluation is made by a third party. It should also be noted, that such observation, either though control group experiments or a third party, may cause 'disruption by evaluation'.

1.2.5 *Similarities to Traditional Methods*

> *"most media of communication can readily perform most instructional functions. They can be performed by pictures, by printed language, by auditory language, or by combination of media. So far as learning is concerned, the medium is not the message. No single medium possesses properties which are uniquely adapted to perform one or a combination of instructional functions. Instead, they all perform one or a combination of instructional functions. Instead, they all perform some of these functions well and some not so well."*
>
> *(Gagné, 1971; cited by Hooper, 1990, p. 9).*

CAL possesses a number of capabilities which are similar to traditional teaching methods; it is capable of feedback and correction of errors, it can keep track of the number of errors made, it can maintain in its memory previously used material that can be individualised for the person's needs, and it can change and update new items based on the student's performance. These and some other similarities are discussed in this section and listed below:

- Flexibility in method
- Flexibility in content
- Feedback
- Portability
- Simulation of Real Life
- Bias

1.2.5.1 Flexibility in method:

Like a human, the computer can be used for an individual, a group, any age, any degree of physical handicap etc.

Hardware

Input and output devices can be designed and modified to suit different needs. For example, this study uses a concept keyboard (money keyboard) to reduce distraction and the need for abstraction. Other aids could include sound, large displays for people with bad sight, and braille keyboards for the blind and so on.

Being able to present things visually is beneficial to many learners; a picture is worth a thousand words. People frequently present information with the aid of graphs, transparencies, slides, and diagrams. "One of the boons of the computer is that it allows the presentation of information in visual displays" (Petty & Rosen, 1987, p. 160). Computer graphics and sound is constantly improving as they can now be

interfaced with a video recorders and CD players to present more realistic, high quality presentations.

Numerous studies indicate that people learn faster, make fewer mistakes, and retain more material with the better graphics and sound that computers are now able to generate. Skinner (1986) states that the "small computer is the ideal hardware for programmed instruction" (p. 110, cited by Stevens, Blackhurst, & Slaton, 1991, p. 153), and has the potential for being an ideal teaching machine.

Software

Computers, if programmed well, are able to accommodate different paces of learning in the same way that teachers can. This is partly achieved through the faultless record keeping of both progress throughout the program. "The computer has the capability to provide different learning options and to track how students use them" (Friend & Cole, 1990, p. 47).

1.2.5.2 Flexibility in content:

Goddard (1983), argues that education should involve setting in motion a process of active development which can enable "the individual ... to unfold his or her unique personality'" (cited by Brechin & Walmsley, 1989, p.44). The computer can be programmed to present a range of material and examples to keep the student stimulated, and can in some cases have access electronically to a larger range of material than a human has. For example, a wealth of pictures, text, and sound is available on CD-ROMs, each of which can hold the equivalent of several encyclopedias.

1.2.5.3 Feedback:

Immediate feedback to the student is one factor which makes CAL effective (Kraus, 1981). Like a human, the computer can provide instant feedback on progress. This can take many forms; a game, print-out of a picture and sounds such as clapping. These appeal to both the visual and aural needs of a person. Reinforcers can be easily varied according to a persons interests.

Skinner argued that feedback is important in the attainment of optimum learning.

1.2.5.4 Portability:

One of the aims of computer developers has been to make both hardware and software more compact. The usefulness of earlier computers was constrained due to their physical size. In contrast computers are now transportable, and many are the size of a

text book. They, like humans, can be moved from one place to another with very little effort.

1.2.5.5 Simulation of Real Life:

The computer's "essence is its universality, its power to simulate. Because it can take a thousand forms and can serve a thousand functions, it can appeal to a thousand tastes" (Papert, 1980, p. viii).

One of the computers primary appeals is that it can simulate a 'real life' situation. Simulation is often less expensive compared to teaching the same skill in a natural environment. This is especially true with people who require much practice, such as people with IH. Such a simulation can be easily organised, variables can be held constant and situations can be contrived for the purposes of practice.

1.2.5.6 Bias:

While it was argued above that CAL can avoid bias, designers and programmers may consciously or unconsciously build their own biases into it. "Technological activity is constrained not only by the knowledge and skill resources available, and the availability of materials and machines, but also by the values of those whose purposes it serves and by the social context in which it is located" (Hodson, 1992, p. 34). There is a need to be aware of the cultural, political and commercial "imperatives" that can exist in software.

However this is also true of conventional teaching methods, as each teacher brings into their lessons their own personal biases which influence the way in which they teach, and to a certain degree the content that they teach. To illustrate, an English teacher who adhered to strict Christian beliefs may not teach their class about a book such as "Lady Chatterly's Lover", and an economics lecturer who had socialist beliefs would not teach that the 'trickle down theory' for alleviating poverty was correct!

There is a need to adopt a critical, questioning approach to technological issues and as in traditional teaching to be aware of different perspectives, such as feminist and Maori ideologies (Hodson, 1992).

1.2.6 *Disadvantages compared to Traditional Methods*

"The whole truths are much more ambiguous than we allow"
(Hooper, 1990, p.12)

There are problems with CAL. This is also true of other educational media, such as television, radio, and film. "Education, I would argue, is a highly ambivalent business, with few simple truths and much complexity as one tries to apply communications and educational technology learning" (Hooper, 1990, p. 11). In this section weaknesses of CAL compared to traditional teaching methods are briefly examined. These include:

- Impersonality
- Lack of flexibility in novel situations
- Narrow range of input mechanisms
- Set-up costs
- Intimidation

1.2.6.1 Impersonality:

Computers provide a major source of instruction which is relatively free of human intervention (Jordon, 1981). CAL does not provide social interaction—it lacks humanity!

The fact that human intervention is not necessary with CAL is seen by some as a flaw, as they think human intervention often provides motivation.

However, this can also be the case with traditional teaching, as it does not automatically involve another person. It is ironic that some of the opponents of CAL as an effective teaching alternative "denigrate its 'one-wayness' without ever admitting that much of conventional instructional method they use is essentially one-way as well" (Hooper, 1990, p. 11). For instance, the lecture is essentially one-way, allowing little more interaction than CAL does. Also, " teachers themselves vary widely in styles, interests and general concern for students. In contrast, computers have the *potential* to emulate the best of methods in student interaction" (Hannafin, Dalton, & Hooper, 1987, p. 9).

1.2.6.2 Lack of flexibility in novel situations

It is difficult, if not impossible, to simulate all variables from the real world with computers as they are at present. The programmer cannot possibly account for every situation in their program, as there are an large number of things that could happen during a teaching program. This results in a lack of flexibility in CAL systems, which

limits its use to particular constrained teaching tasks. Computers are not, therefore, good at ensuring "incidental learning" whereas human teachers can seize such opportunities (Charles, Glynn & McNaught, 1986).

1.2.6.3 Narrow range of input mechanisms

The computer also has a narrow communication channel and knowledge base. That is, the computer can not presently really understand natural language beyond word recognition, or even produce it convincingly. However, this technology is currently being developed. For example, Apple recently produced a system called *PlainTalk*, which can produce realistic voice and do some voice recognition. However, at the present time, unlike a human teacher-student interaction, the majority of learners using CAL are unable to ask the machine questions and get a response or ask it to slow down or speed up etc.

1.2.6.4 Set-up costs:

The initial set up costs of computer hardware can range from a few hundred dollars to thousands. Software is also varied in price, depending on its capabilities, and which company is providing it.

Many people are still reluctant to purchase such equipment as the technology is changing rapidly, and they are unsure of what is best value for money. Computers are expensive, yet the question that needs to addressed is "more expensive than what?" "They are, perhaps, typically more expensive than current textbooks, workbooks, and most other print-based media... computers can look prohibitive compared with conventional print-based material. However, rationale is adding versus shifting costs" (Lai, 1992 p. 9).

Cost is a disadvantage at present. Yet, prices are constantly decreasing as technology improves and competition grows. There is also a need to resist purely financially driven curriculum dictates; innovation in instructional methods needs to continue!

1.2.6.5 Intimidation:

There are a number of barriers which alienate computers from many people. One is simply physical isolation from such technology. There are also political barriers, such as people who live in cities and are surrounded by technology but see it as belonging to 'the others'. Some of the barriers are even more abstract: 'mathaphobia', which keeps people from claiming maths as their own (Papert, 1980).

It has been argued that "computer assisted learning seems to raise more problems than does say, educational television. People are not only very familiar with television, but almost every household has one. People are not only unfamiliar with the computer but are alienated by, amongst other things, its complexity. It may be difficult to get across basic points about computer-assisted learning, because people are distracted by the technological sophistication" (Hooper, 1990, p. 4).

However, the inverse has also been thought, that television can be watched passively, requiring no interaction, so often learning may not be taking place. As Frank Lloyd Wright once wrote, "television: chewing gum for the eyes". Williams (1990) refers to a study by White, Mathews and Holmes (1989) which indicates that it is not just the visual and audio stimulation that effects rates of learning, but also the interactive responding that the computer allows.

Therefore, it is important to try and educate people, to show them "how computers can be carriers of powerful ideas and of the seeds of cultural change, how they can help people form new relationships with knowledge that cut across the traditional lines of separating humanities from sciences and knowledge of the self from both of these" (Papert, 1980, p. 4). It is also important that people start to produce machines which are 'user friendly', software that is both educational and interesting, especially as the computer is trying to appeal to people who are from a TV world of instant gratification, sound, and colour.

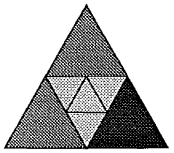
"Overcoming 'computer apprehension'—which for some, verges on 'computer phobia'—will need to be a major goal for teacher education programmes" (Hodson, 1992, p. 43).

1.2.7 *In Summary:*

"All of us, professional as well as laymen, must consciously break the habits we bring to thinking about the computer. Computation is in its infancy" (Papert, 1980, p. 5).

Computing technology is very much in its teething stages, and needs to develop before some of the problems are ironed out. It is hard to think of the computers of tomorrow without the limitations of today, but it is important that we try. Brand (1987) described CAL with an analogy "the wired world is a teenager with a new car, taking dumb risks, finding new freedoms. It's a privilege to be around self-discovery like that, but gruelling, and sometimes tragic" (p. 249). CAL has great potential for *all* people! Computers are about an end to the culture that makes science and technology alien to the vast majority of people (Papert, 1980).

Computers have potential for "connecting, diversifying, increasing human complexity rather than reducing it — these are instruments of culture" (Brand, 1987, p. 263). If computing technology can be appropriately harnessed for instruction, there are significant advantages to be gained. Taking the disadvantages that computers present into account, and using them where they are most productive, will surely lead to improvements in the way we teach. This study investigates the parameters of CAL in a specific situation.



1.3 Money

"Those who have some means think that the most important thing in the world is love. The poor know that it is money"
(Gerald Brenan)

Most people would accept that money is an important part of functioning in today's society. As such it is difficult to justify without appealing to 'common sense'. This section attempts to argue its importance on a more principled basis. "Most people think that they know what they mean when they use the word 'Money'. In fact, however, different people frequently mean different things when they say 'Money'" (Rosenberg, 1973, p. 1).

The term money has "at least four distinct qualities or functions" (Rosenberg, 1973, p. 1). The distinction between these is often not made, and this in turn causes confusion.

Money functions as a:

- ❖ medium of exchange
- ❖ store of value
- ❖ common denominator
- ❖ standard of deferred payments

(Rosenberg, 1973).

Historically, and for the purposes of this research, money's function as a medium of exchange is the most relevant. "It derives its significance from the fact that modern society is based on the division of labour" (Rosenberg, 1973, p. 1).

Money became a medium for exchange because a product produced by one person may not be a useful item to exchange with another's. Adam Smith (1776 [chapter 4], cited by Rosenberg, 1973, p. 1) stated that "in order to avoid the inconvenience of barter, every prudent man in every period of society, after the first establishment of the division of labour, must naturally have endeavoured to manage his affairs in such a manner as to have at all times by him, besides the peculiar produce of his own industry, a certain quantity of some other commodity, such as few people would be likely to refuse in exchange for their produce of their industry".

The commodity kept for the purpose of exchange is money.

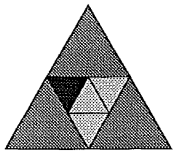
Without money as a medium of exchange, division of labour would become almost impossible. "The very burden of exchange, of finding someone who has what you want and who at the same time is in need of what you have, would absorb most energies now devoted to production" (Rosenberg, 1973, p. 2).

"The first and most important feature necessary for a good medium of exchange is that it must be generally acceptable" (Rosenberg, 1973, p. 5). If a thing is acceptable by everyone, it can at all times be used as a means of payment. It is as a means of payment that money as a medium of exchange obtains its importance.

We also tend to use money as a measure of worth. What a person is paid is usually dependent upon the availability of their skills. A medical practitioner is paid a great deal more than a supermarket packer, as their knowledge and skills are rare.

Money may take on many visible forms (Rosenberg, 1973). In New Zealand money is made of both metal and paper. "Money may also be invisible, usually in the form of bank deposits" (Rosenberg, 1973, p. 37). Invisible money is widely used in today's society, for example cheques and EFT-POS. This research is concerned with money in the form of coins—not invisible money.

Money and its exchange is a vital part of life today. Money holds a key role in the way that people function and the reasons why they work—it is a means of survival, and skills in dealing with money are an important part of living in society.



1.4 CAL and people with IH

"Technology plays a vital role in the lives of all persons in our society, but, for persons with mental retardation, the promise of technology is particularly well recognised" (Parette, 1991, p.165). "Computers and special education have been described as 'natural partners'" (Summers, Cartwright, & Lukasevich, 1987, p. 24).

Over the past two decades there has been a proliferation of technological advances in the fields of rehabilitation and special education (Parette, 1991). Numerous CAL programs have been produced to meet needs in special education (e.g., Brebner et al.,1980; Ryba, 1980; & Emslie, 1991). This made it possible for many educators to realise the potential of CAL for people with IH (Riedesel & Clements, 1985). Skinner (1953) with his early teaching machines realised the capabilities of the computer to provide effective instruction. Researchers such as Brebner et al. (1980) also started to use computer technology before the advent of the personal computer. However, "only when computer usage is located within a discourse of educational theory that focuses on the nature of knowledge, teaching and learning will we be in a position to use this powerful technology in an educational way" (Hodson, 1992, p. 43).

1.4.1 How CAL can meet the needs of people with IH

"It is obvious that the potential for the computer's use in special education is 'mind boggling', but its true potential can only be achieved when educators who know what they need to teach can cooperate and communicate with computer scientists and programmers"
(Schiffman, Tobin, & Buchanan, 1982, p. 559)

CAL has been used to teach people with IH for many years and in many forms. "Computers can be used to open up learning opportunities for students with disabilities. This is education, in its original derivation— 'leading out'— affording us insights into the minds and motivations of students, and affording them control over their surroundings" (Curzon et al., 1992, p. 221).

CAL "results in better achievement in less time and with more positive student attitudes than traditional instruction, especially with below average ability students" (Bass et al., 1986, p. 208). This section looks specifically at why and how people with IH benefit from CAL.

Listed in below are specific handicaps that are often associated with the term 'intellectual handicap'. Not all of them are be applicable to all people with IH , but they indicate needs that education, in all areas of the curriculum should take into account. Beside each handicap are the solution(s) that CAL offers.

Specific Handicaps	CAL solutions
Poor Working Memory Difficulty coding	Immediate feedback Simplified interaction, through: • visual flexibility • aural production ability • specialised hardware
Lack of control of environments	Allows people to set their own pace • start and stop when they wish • if desired you can work for hours
Need repetitive instruction	Computers are patient and don't get bored, so can provide endless drill and practice exercises.
Suffer from: discrimination ridicule	Computer programs operate impartially, subject only to biases inherent in the program. Allow people to make mistakes without embarrassment, thus increasing motivation.
Often have secondary disabilities: visual aural physical	Hardware and software can be built to meet the needs of people with IH with secondary disabilities • Large characters/pictures • Audio instruction • Concept keyboards/special switches

1.4.1.1 Working Memory

An important characteristic of most people with IH is their limited working memory and inability to attend to relevant cues. Working memory is necessary to remember ideas and thoughts for problems that are currently being solved. "It is generally concluded that mentally retarded children are less efficient in focussing attention during a learning sequence and are more easily distracted than normal children are" (Yussen et al., 1982, p. 342). This means that the learner's environment should be a simple as possible, in order to minimise distractions, and the learning process should be as exciting as possible.

CAL's solution

"A number of professionals have suggested that direct and frequent measurement may have the most positive effect on student learning"
(Baumgart & Van Walleghem, 1987, p. 57)

Poor working memory can mean that traditional classroom settings which often have delays in feedback, could perhaps cause an IH person to lose sight of the tasks at hand. CAL software can be written to offer individualised instruction and immediate feedback (Schiffman et al., 1982).

Feedback is important in IH education. Skinner (1986) argued that it is vital for the attainment of optimum learning. He emphasised that "effective programmed instruction should prime the student for learning by providing correct models that may be easily imitated by the learner and result in accurate responding" (cited by Stevens et al., 1991, p. 153).

There is a great deal of research on feedback in CAL (Anderson, Kulhavy, & Andre, 1971; Waldrop, Justen, & Adams, 1986; Kraus, 1981; Malouf, 1988; and Foster, Williams, MacMillan, & Temple, 1986), however there is little research on feedback, specifically for IH populations.

Knowledge of results plus corrective feedback has been found to be very beneficial for people with IH. Cohen (1985) "suggests that immediate feedback is necessary for the individual who is performing at a low mastery level" (cited by Waldrop et al., 1986, p. 45). Other research has pointed to feedback after each incorrect response coupled with corrective action is best for facilitating learning for the less able (Waldrop et al, 1986). Computers, if appropriately programmed can give this sort of immediate response, with as much or little corrective information as the teacher or student wants. This is helpful, as in a traditional classroom setting where demands on a teacher are numerous, they are often unable to provide this sort of immediacy. "Recognition and celebration of computer achievements can have powerful impact on student motivation and skill development" (Selby, 1992, p. 25). Immediate feedback in a consistent format which can be easily recognised is beneficial in the facilitation of IH learning and CAL, if so programmed, can provide this.

1.4.1.2 Difficulty Coding

Coding is the process that transforms external stimuli into internal representations. People who are IH tend to have problems coding information (Brebner et al., 1980). IH learners "often do not process information or apply knowledge effectively" (Montague, 1992, p. 230). The information that they are presented with therefore needs to be both simple and frequently reiterated.

CAL's solution

There are numerous ways in which CAL can help with difficulty coding. There are input and output devices which require less coding by the user.

Output devices can be made to include sampled and synthesised speech and photographic quality images. "Although too many instructions confuse the handicapped (Brown & Hughson, 1972), a small amount of audio output has been demonstrated to enhance their learning" (Brebner et al., 1980, p.5). Visual aids are also beneficial as many people with IH are unable to read, and their learning can be aided pictorially.

Simulation of the world with realistic graphics and sound also anchors learning in more realistic situations than the traditional classroom setting, which can decontextualise learning. The computer can therefore present representative tasks to which IH learners will have to apply their knowledge and skills in the future—reducing the need for coding and abstraction.

Hardware input devices like a concept keyboard (e.g., money keyboard) can also simplify the coding required, through "facilitating learning by eliminating some of the superfluous mental processes otherwise required of the learner using the standard keyboard" (Brebner et al., 1980, pp. 5-6). A money keyboard allows a subject to indicate the cost of an item, simply by touching the notes and coins to the amount required: it is no longer necessary to recode from an amount shown on a price tag, to standard keyboard symbols, without any reference to the bills and coins which would be used in a real purchase (Hallworth et al, 1980).

These sorts of keyboards can also be made to be more robust than an 'average' one. Use of an alternative input device is often preferable, even when a student may be able to physically use a regular keyboard. "Use of a switch, for example, may free the student from anxiety and delay in finding particular keys and instead allow them to concentrate on the content of the program. It can reduce failure rate and the associated lack of self-esteem" (Curzon et al., 1992, p. 228).

1.4.1.3 Often Feel a Lack of Control

Learner control refers to allowing the learner some control in a lesson (Friend et al., 1990). "Many researchers argue that personal control is a basic human need" (Selby, 1992, p. 20). People with IH, even in semi-independent living environments, frequently lack control over many of their activities. This is especially true in educational environments. Traditionally in teaching, "it seems that the greater the learning difficulties, the more didactic is the approach and the more controlling the relationship." (Brechin et al., 1989, p. 44). A sense of personal control is particularly important for IH "students who because of their intellectual disabilities have had many experiences in the past that have been totally disempowering" (Selby, 1992, p. 20).

Skinner's experimental analysis of behaviour showed that the learner is more than a receiver of information and must engage in an activity. This is especially important in learning to study, think, be creative, and to develop a love of the subject (Mitchell, 1988).

Development of control is important for improving performance in slower learners. Fostering learner control (perceived or otherwise) may help people to accept greater responsibility for their learning. Research has indicated that this sort of control in turn helps to motivate with their learning (Hansen, 1982).

CAL's solution

CAL can be learner centred—with students actively participating in the learning process, thus giving some control to the student.

Papert (1980) argues that people should be in charge of their learning—they should program the computer, rather than the reverse.

Ryba (1980) suggests that people who are IH feel in control even when using drill and practice CAL. He states that this is because their lives are usually directed by others, and CAL actually allows them to work independently—alone. He goes on to say that this is vital as there are few opportunities for learner control in more traditional methods of teaching. Using CAL the learner may "control lesson pace, sequence, content, or feedback" (Friend et al., 1990, p. 47).

Hodson (1992) stated that "student centred and student controlled learning methods commonly employed in technology education are amongst the most effective ways of building self-confidence and self-esteem" (p. 35). Okolo, Rieth, and Bahr (1989) found that five teachers stressed this aspect of CAL with learners who were IH. That is, "recognition and support received in the computer environment can help enhance

self-esteem, self confidence, and motivation, all of which are transferable to other learning situations" (Selby, 1992, p. 25).

1.4.1.4 Need Repetitive Instruction

For many skills to become automatic, extended practice is generally needed. "However, evidence suggests that students who are mildly mentally handicapped do not develop automaticity as easily as non handicapped students and may require a greater amount of practice" (Podell, Tournaki-Rein, & Lin, 1992, p. 200).

Repetition of both instruction and problems also means that there is more structure in the intellectually handicapped person's learning, supporting the connection that "low ability pupils as well as highly anxious students have a preference, and are better off with instructional treatments that offer more structure and guidance" (Cornor & Snow, 1986, cited by De Corte, 1990, p. 74).

CAL's solution

There are many forms of CAL (see *section 1-2*), (e.g. simulation, drill and practice). Traditionally the most common form used with the people with IH is drill and practice. Drill and practice CAL programs offer repetition of points to be learnt. Okolo et al. (1989) found that the teachers they interviewed who used CAL for people with IH "commented on the benefits of practice and repetition" (p. 111). Repetition promotes over learning and also leads to automaticity of many learning tasks.

CAL lends itself to this method of teaching, as a computer doesn't get bored or frustrated with tasks. "CAI is an infinitely patient teacher" (Baumgart et al., 1987, p. 57). Also, "drill and practice can become exciting through the use of animation, sound effects, and game-playing situations" (Schiffman et al., 1982, p. 558).

Using a computer for "drill-and-practice can eliminate the need to copy problem after problem on paper" (Lee, 1989, p. 29), which is a task many people with IH find difficult. This also means that students are able to get more problems finished in less time: "the extra practice they need is accounted for in a fraction of the time required by pencil-and-paper practice" (Lee, 1989, p. 29).

1.4.1.5 Potential for Discrimination and Ridicule

People with IH can be subjected to ridicule and discrimination both intentionally and unintentionally. To illustrate, "Special education teachers may unintentionally infantilise students with disabilities through the use of childish materials (early childhood books and teaching methods)" (Selby, 1992, p. 25).

CAL's solution

"The non-judgemental computer environment is perfect for students who have suffered repeated failures" (Curzon et al., 1992, p. 219). CAL has also been shown to boost people's self confidence since they do not need to display performance to the class (Hanson, 1984). This can then help their ability and desire to learn. CAL environments can be set up to be both interesting and age-appropriate, providing "a learning environment that is suitably mature and motivating for older persons" (Selby, 1992, p. 25). It does so, because it can provide a non-judgemental learning environment in which a student can make mistakes without embarrassment (Schiffman et al, 1982). That is, the computer will wait as long as necessary for the learner to grasp the concept. "They will soon perceive the computer as a non-threatening medium where they can risk being wrong" (Lee, 1989, p. 29).

Also, "failure cannot be experienced as the opportunities are limitless and the computer does not become impatient!" (Curzon et al., 1992, p. 220). The computer doesn't "respond on an emotional level and does not mind repeating itself several times" (Schiffman et al., p. 558). In short, computers cannot display verbal and non-verbal cues indicative of impatience, disdain, criticism or disappointment which human teachers may emit in response to errors, delays, and persistent ineptitude.

CAL can help eliminate some of the prejudices and discrimination that people with IH often experience, therefore "people with disabilities can be accepted by, have interactions with, and equal access to the same places that non disabled persons have in our society" (Parette, 1991, p. 166).

1.4.1.6 Secondary Problems

People with IH (especially the moderately and severely handicapped) often have secondary disabilities—associated or multiple handicaps—as well as their intellectual one. "Secondary disabilities include speech, visual, and physical impairments" (Parette & Van Biervliet, in press; cited by Parette, 1991, p. 166).

It used to be thought that secondary problems for people with IH were among the moderately and severely handicapped, however "recent studies have also indicated that

associated, or multiple handicaps are common among persons with mild retardation" (Parette, 1991, p. 166). These secondary problems need to be addressed in the design of instruction for people with IH.

CAL's solution

In addition to the coding benefits, the provision of large, bright text and graphics for the visually impaired is one way that CAL can meet the needs of people with IH with secondary handicaps.

The computer is particularly good at communicating non-verbally, as it was traditionally designed specifically to be non-verbal (it has a verbal handicap at least equal to that of a person who is moderately IH!). Due to computers' poor verbal communication, most CAL systems rely on graphics and text to communicate, and this is appropriate for people who have a verbal handicap.

This handicap, while a boon for some, is a drawback for other people. However, this is being addressed. "One of the most exciting developments relating to special-needs peripherals has been the speech-recognition technology" (Williams, 1990, p. 36). This can enable people who are too physically impaired to use any sort of keyboard to tell the computer their commands—the computer is able to 'hear' commands!

Concept keyboards, also meet the needs of people with physical handicaps, with its provision to make keys any size needed, add colour and texture. The range of alternative keyboards is great including; "joystick, mouth stick, tongue switch, or pneumatic puff and sip switch" (Williams, 1990, p. 36).

1.4.1.7 General IH needs and CAL Solutions

Since students who are IH often "need a combination of visual, auditory, and kinaesthetic stimuli, to learn best, programs that employ multi sensory approaches will be more valuable for them" (Schiffman et al., 1982, p. 558).

In the early 1950's, Skinner claimed that since people learn at different rates, they ought to have individualised programs to meet their needs (Kay et al., 1968). "In an interview with Zienatra (1983), Skinner stated that he believed the computer would provide the educators with opportunities to improve education in the way he and his colleagues had attempted to do three decades ago" (Zientara, 1983, cited by Emslie, 1991, p. 2). CAL allows interaction with the material that they are supposed to be learning. "Active discovery is preferable to passive receptive learning" (Selby, 1992, p. 19). Okolo et al. (1989) reported that when teachers of IH students were asked about

the benefits that CAL offers, they stated that it is "' a more interactive manner of instruction' or 'a way to increase active engagement' " (p. 111). This is congruent with Skinners belief that people should be active participants in the learning process (Kay et al., 1968).

Another advantage of CAL as a tool for instruction for people with IH is its flexibility. Computers, when fitted with suitable devices and good software, enable people with IH to learn in ways that meet their needs. Selby (1992) states that one of the principles of learning for people with IH is that the CAL incorporates the "flexibility that permits the learner to establish plans to reach a distant goal" (p. 19).

"Motivation is fundamentally important in the learning process" (Selby, 1992, p. 19). Okolo et al. (1989) reported that with mildly handicapped students, the teachers in their study said that "microcomputers motivated their students by offering novelty and variety and by capturing their attention" (p. 111). Okolo et al. (1989) found that mildly people with IH expressed positive opinions about CAL. The majority "wished to learn more about computers and to use them more often. The students did not find computers difficult to use and expressed a desire to own their own computers" (p. 115).

Another of the benefits that CAL offers people with IH is the provision of opportunities for greater participation in the mainstream of society (Parette, 1991).

"Though technology holds exciting possibilities for enhancing the quality of life for persons with mental retardation, the promise can only become a reality as attitudes toward the potential and value of these persons evidence a corresponding change" (Parette, 1991, p. 176).

1.4.1.8 Summary

"Through its ability to provide an emotionally secure and non-threatening learning environment, provide rapid and informative feedback (sometimes with appropriate remedial teaching), give encouragement, give the learner a much greater measure of control, and enhance self-esteem by providing opportunities to use a powerful late twentieth century technology, computer based learning plays a major role in furnishing an affective climate for successful learning" (Hodson, 1992, p. 42). CAL is especially suited in many ways to the instruction of people who are IH, which makes it a teaching technique worthy of further investigation.

Authors	Year	Title	Age	#	Intelligence	Design	Software	Hardware	Training Method	Task	TS	TT	Conclusions
Podell, Tournaki-Rein, & Lin	1992	*Automatization of Mathematics Skills via CAI Among Students With Mild Mental Handicaps*	$\bar{X}$ = 8	94	Mildly IH and Non IH	Group	Math Blaster:, with authoring capabilities, timer, built-in scoring	Apple II	D&P CAI vs Paper + Pencil	Addition and Subtraction skills	No	No	CAI is better than pencil + paper at teaching these skills. IH don't achieve automaticity easily .
Dube, McDonald, McIlvane, & Mackay	1991	*Constructed-Response Matching To Sample & Spelling Instruction*	24 & 27	2	mental age = 4.1 & 4.7 years	SS MB	Custom	Macintosh & touch screen	Constructed response MTS	Spelling	No	No	CRMTS can teach spelling., and maintenance occurred
Stevens, Blackhurst & Slaton	1991	*Teaching Memorized Spelling with a Microcomputer: Time delay & CAI*	11-12	5	2 Educable Handicapped & 3 LD	SS MPD	*Waiting to Spell* authored using Apple SuperPILOT	Apple II	CAI with prompting after time delay	Spelling	Yes	No	CAI with time delay can teach spelling, and transfers to pencil+paper tests
Emslie	1991	*Computer Assisted Learning: Money Skills; teaching appropriate use of coins to children*	7-8	5	LD	SS MB across subjects	Custom	Commodore 64	D&P	Money Skills	Yes	No	CAL can teach money skills to LD primary school students, and skills generalise to simulated purchases
Baumgart & Van Walleghem	1987	*Teaching Sight Words: A Comparison Between CAI & Teacher Taught Methods*	18, 41, & 45	3	Moderately IH	SS MPD	based on *Speak Up* by Wilson & Fox, 1983	Apple II & speech synthesiser	D&P	Recognising Aisle words	Yes	Yes	CAI can teach IH adults to recognise words, but only 1 subject generalised to the real world
Howell, Sidorenko & Jurica	1987	*Effects of Computer Use on the Acquisition of Multiplication Facts by a Student with LD*	16	1	WISC-R = 112low math skills level	SS	*Galaxy Math*	Apple IIe	D&P with teacher intervention	Multiplication problems	No	No	CAL needs teacher intervention for maintenance to occur
Harper & Ewing	1986	A Comparison of the Effectiveness of *Microcomputer & Workbook Instruction on Reading Comprehension Performance of High Incidence Handicapped Children*	11.5-13.5	9	Mildly handicapped & LD	SS ATD	*Comprehension Power*	Apple IIe		Multiplication problems	No	No	
Bass, Ries & Sharpe	1986	*Teaching Basic Skills Through Microcomputer Instruction*	9-11		LD	Group	*Various*	Apple II	D&P and tutorial vs traditional	SRA reading and maths	No	No	CAI can contribute to learning as an addition to traditional techniques
Chiang	1986	*Initial learning & transfer effects of microcomputer drills on LD students' multiplication skills*	$\bar{X}$ = 10	6	LD	SS	*Multiplication training programs*	Not stated	D&P	Multiplication skills	Yes	No	Unclear
Fuson & Brinko	1985	*The Comparative Effectiveness of Microcomputers & Flash Card s In the D&P of Basic Mathematics Facts*	7-9	84	Normal	Group	Custom	Apple IIe	D&P CAI vs flashcards	Math skills	No	No	Flashcards can replace CAL very simple fact D&P
McDermott & Watkins	1983	*Computerized vs. Conventional Remedial Instruction for Learning Disabled Pupils*	5-11	250	LD, WISC-R $\bar{X}$ = 93	Group	*The Math Machine & The Spelling Machine*	Apple II	CAI vs traditional	Maths and spelling	No	No	CAL is equivalently useful to traditional techniques
Brebner & Hallworth	1980	*Research and Practice in CAI for the Developmentally Handicapped*	16-50	170	Moderately-severely IH	-	Custom	PDP-11 and microprocessor	D&P	Money Skills and Spelling	Yes	No	CAL works, subjects enjoy it, and skills generalise to simulated purchases

Table 1-2: Research on CAL and people who are IH

1.4.2 *Review of Related Research*

The growth of computer use in special education has stimulated research and demonstration projects. *Table 1-2* briefly describes a range of research that uses CAL to teach people with IH and learning disabilities. These studies have been classified according to age and number (#) of subjects, intelligence, design of the studies, software, hardware, training method, tasks, whether transfer to the real world was tested (TT) and transfer to a simulation was tested (TS) and conclusions.

Skills

Five of the studies taught only mathematics skills, two spelling, one money skills and one reading of aisle names in a grocery store. Three of the studies taught both maths and spelling. The mathematics only studies were taught to the learning disabled. The three mathematics studies each taught multiplication.

Age of Subjects

All but Dube et al. (1991) and Baumgart et al. (1987) studied children (under 18 years). These two studies used subjects aged from teens through middle-age.

Design

Group and single subject designs have been used in the studies using CAL. Of the 12 studies reviewed seven of the studies adopted a single subject design. Changes in behaviour were measured by a multiple baseline across subject design (e.g. Emslie, 1991), multiple probe design (e.g. Stevens et al., 1991) and alternating treatment design (Harper et al., 1986).

Brebner et al. (1980) did not adopt a research design, as the study was essentially anecdotal. All of the other studies used group design. The group ranged in size from 84 to 250. The single subject designs varied in size from 1 to 9 subjects.

Training Method

The most common application of computer assisted instruction used was drill and practice.

Hardware

Eight of the studies used Apple II or Apple IIe personal computers. Chiang (1986) did not state the type of hardware he used. Dube, et al. (1991), Emslie (1991), and Gardner et al. (1985) used a Macintosh, Commodore 64 and Kaypro respectively. The only study that did not use a personal computer was the earliest research reviewed, by Brebner et al. (1980) who used a PDP 11.

Transfer of Training

One problem noted in the literature is that skills taught to people with IH in a classroom setting were not applied to the 'real' world. The bulk of the research has been done in the institution and there is a need for more in the community, as the majority of people with IH live there (Singh & Blampied, 1983).

Baumgart et al. (1987) is the only study out of 12 which investigated transfer to the real world. The CAL taught three moderately handicapped people how to read aisle names in a grocery store. He found that out of three subjects only one transferred the skills learnt to the real world.

The studies described can be classified by two criteria:

- ❖ studies that compare CAL and traditional teaching methods vs those that study CAL in isolation
- ❖ Those that test some form of transfer (usually to pencil and paper tests) vs those that do not.

1.4.2.1 CAL compared with traditional teaching methods

There were a total of four studies that assessed the difference between CAL teaching methods and conventional teaching. They all used group designs, while those looking at the efficacy of CAL instruction used single subject designs, where baselines before intervention act as control mechanisms.

Fuson et al. (1985) compared the effectiveness of flashcards with CAL instruction with both learning disabled and 'normal' intelligence children. They used the same design for the flashcard presentation as used in the CAL—drill and practice, individualised programs, and the use of immediate feedback on the accuracy of the response. Their results indicate that there was no difference in the accuracy of the skills learnt between the two teaching methods. They point out that their results do not necessarily apply to all forms of drill and practice, but do for the teaching of division and subtraction. After four weeks, the researchers changed the groups that subjects were assigned to, and found an increase in motivation, which was attributed to the novel leaning environment. This suggests a need to change the learning method from time to time, in order to keep motivating the learners. The value of their study lies in the fact that the main variable was the use or non-use of computers; they held the teaching method constant, which isolates the effect of the teacher on the learning. They suggested future research to examine other teaching techniques using the principles of CAL design in traditional teaching and then comparing effectiveness.

McDermott et al. (1983) used a group design to compare CAL with conventional teaching methods. They assigned subjects to either mathematics or spelling tasks for each method. A total of 205 subjects participated. Their conclusions were that CAL yielded the same results as traditional remedial teaching. They take this one step further, presenting the hypothesis that "when CAI is used as a supplement to rather than a replacement for traditional teaching, levels of summative criterion achievement are consistently higher than for either instructional method in isolation" (McDermott et al., 1983, p. 86). They suggest that the combination of teaching techniques should be used more. However, it should be noted that the conventional instruction was simply the regular instruction that subjects received in their elementary schools. Therefore there were two variables, whether the teaching agent was a computer or a person and what instructional format was used (i.e., drill and practice vs tutorial instruction). Even with the limitation of using a drill and practice methodology the CAL system produced the same results as traditional teaching in spelling and mathematics.

Bass et al. (1986) compared the effectiveness of traditional versus CAL instruction for both reading and mathematics with learning disabled students. There were 260 in the CAL group and 159 in the control group. There results indicate that subjects did learn using CAL to teach reading and mathematics, however not significantly better than the control group. Their recommendation was that "CAI, as an additional instructional strategy, can contribute to improving reading and mathematics performance with low achieving students" (Bass et al., 1986, p. 217).

Podell et al. (1992) compared CAL to a paper-and-pencil approach to teach the automatization of basic addition and subtraction skills. Their study had 98 subjects, and used a trials-to-criterion approach. They also compared non-handicapped with handicapped students. Both groups achieved accuracy using both instructional techniques. However, the CAL group needed fewer trials than the paper-and-pencil condition for the time criterion. The mildly handicapped people needed more trials to reach the criterion level, in both media for subtraction tasks and in the CAL for addition task than their non handicapped peers.

None of these studies tested generalisation or transfer of training. The study which has the strongest result is that of Fuson et al. (1985) as the CAL and teaching method were constant, therefore the effects could be measured with more accuracy than the other studies. They found CAL to be just as effective as the traditional methods of instruction.

1.4.2.2 CAL and transfer to simulation

Brebner et al. (1980) was the earliest study reviewed. It did not include any empirical design or results; much of their discussion was anecdotal in nature. Their CAL system was based on behavioural principles in education of one-to-one tuition and immediate feedback. It also included realistic graphics using multi-media. They found that subjects not only enjoyed the program but they also learnt from the CAL system. They also noted that subjects appeared to be more motivated to work using the CAL system. An important result was that the skills taught transferred to a simulated purchasing situations. They highlighted the need for more research into examining transfer to the real world. "More extensive work on such transfer is required, preferably including some behavioural observation data" (Hallworth, Brebner, & Brown, 1980, p. 22). See *section 1.8* for a more detailed account of this study.

Chiang (1986) set out to test whether or not multiplication skills taught using CAL would transfer to paper and pencil tests. He used six subjects, and all six successfully transferred the skills learnt within twelve days of the drill and practice CAL. He emphasises the importance of automaticity in the learning of a skill, and concludes that CAL can help students achieve this. As a topic for future research, he suggests varying the verbal repertoire of the system to avoid loss of user interest.

Baumgart et al. (1987) was the only study which tested transfer in the real world. They set out to teach recognition of grocery aisle words using a multiple probe design. They used a CAL drill and practice system to teach three moderately handicapped adults, but found that only one subject transferred these skills to an actual supermarket situation.

Emslie (1991) taught 5 learning disabled children money skills using a custom-written CAL program. The design used was a single-subject multiple baseline across subject. She found that the children did learn money skills using CAL and that all of them generalised these results to a simulated purchasing situation. She tested subjects using real coins to buy items drawn on cards. The test was administered one-to-one in a regular classroom setting. See *section 1.7* for a more detailed account.

Stevens et al. (1991) taught spelling to two intellectually handicapped adults using a multiple probe design across subjects. They tested transfer to a paper and pencil test after teaching the subjects using a time-delay drill and practice CAL system. They found 100% transfer immediately after intervention. After 15 days, this dropped to 80.6%. When comparing generalisation probes with computer probes within 30 minutes of each other, generalisation scores exceeded computer probes 29.4% of the

time, were equal 60.7% of the time, and were lower 9.8% of the time. They suggest that this may be due more to typing mistakes than to actual spelling errors. An extension of this study might use a voice or stylus input device to reduce this problem.

1.4.2.3 Summary

Long-term maintenance and generalisation of essential acquired skills are crucial to community-living success. However, the community-skill training literature has primarily emphasised acquisition, and has almost universally omitted to test transfer in the real world. This is partly due to the abstract nature of the tasks that are taught, but the question of the suitability of these tasks must also be asked. Brebner et al. (1980) believe that arithmetic skills taught to people with IH should be grounded in a socially relevant context. The one study that did test transfer in the real world reports that only one subject (out of three) generalised successfully from the training setting to a supermarket.

It is also interesting to note that almost all of the tasks taught using CAL to people with IH is easily broken down into small, achievable steps (e.g. spelling and maths). Capitalising on the sequence of small steps, almost all of the studies reviewed use drill and practice teaching techniques, as recently as 1992.

Single subject design was the most widely used, using from 1 to 9 subjects.

This study adopts similar methods to the studies reviewed here, using a single-subject multiple probe design and a drill-and-practice teaching technique. However it differs from the majority in that socially significant skills were taught, and transfer of training to the real world was tested.

1.4.3 *Principles of Instructional Design*

"A structure or plan for incorporating this newer resource into good teaching practice is vital"
(Curzon et al., 1992, p. 221)

Although CAL holds exciting promise for enhancing the quality of life of people who are IH, it needs to be based on sound educational principles; principles which apply to instruction generally. For instruction to be successful, both the context of the teaching (the wider life of the learner), the learning environment (the specific parameters of the instruction) and behavioural principles of the teaching method being used need to be taken into account. These are briefly outlined in turn below.

1.4.3.1 Teaching Context

"Inherent in the goal of optimum functioning is an emphasis upon the *person* and his/her ability to participate in the mainstream of society to the greatest extent possible" (Parette, 1991, p. 165). There is increasing support among researchers, practitioners and parents for educational programs that encompass such practices as:

- Age appropriate placement
- Integrated delivery of services
- Social integration
- Transition planning
- Community-based training
- Curricular expectations
- Systematic data-based instruction
- Home-school partnership
- Systematic program evaluation

(William, Fox & Thousand, 1990, p.120).

These are broad educational objectives, which should be considered when selecting subject matter and teaching methods.

On a national level, the Mental Health Foundation of New Zealand reiterates these objectives stating that educational programs for people who are IH "should be based in the community and be integrated within it. Needs assessment should precede planning; and planning should involve partnership between many groups involved with community care. The Treaty of Waitangi should be honoured and services should

be sensitive to cultural and other differences between people" (Maori Mental Health Consortium, October 1989, cited by Atawhaitia, 1991, p. 34).

1.4.3.2 Teaching Environment

The learner and teacher can do much to facilitate learning, particularly in creating environments where the learning is likely to proceed more efficiently (Kay, et al., 1968). What teaching and social practices are needed to enhance students' learning?. Below is a checklist for an effective teaching environment, adapted from Ryba and Anderson, 1990, cited by Ryba , 1992, p. 96.

- Create socially interactive learning
- Help students to set goals for learning
- Encourage and allow time for reflection
- Reinforce correct behaviour and provide informative feedback
- Have a warm, positive learning environment
- Focus on social competence
- Model behaviour for students
- Collaborate with students
- Involve your students

1.4.3.3 Behavioural Learning Theory-Based Computer Courseware

"Certainly computer technology is not going to lessen in the near future, and behavior analysts may already be sadly behind "
(Williams, 1990, p. 38)

Psychologists have long studied learning and the factors influencing it. However, Williams (1990) states that "few [studies] have been evaluated against what might be called the 'ABC's' of behavioral principles" (p. 34). To address this criticism, a behavioural view of CAL courseware is briefly presented here. How the CAL system designed for this research relates to these behavioural principles is covered in *section 2.3.1.6.*

For CAL to meet the needs of behaviour analysis, several factors need to be addressed, in particular the three-term contingency or ABC's of behaviour: antecedents, behaviours and consequences (Williams, 1990). "All applied behavior analysis procedures involve manipulation of one or more components of the three-term contingency" (Cooper, et al., 1987, p. 30).

CAL can make "use of the computer as an agent for delivery of antecedents, a tool for responding, or an instrument for delivery of consequences" (Williams, 1990, p. 34).

The following three sections briefly describe some techniques for implementation of the three-term contingency using computers.

Antecedent Stimuli

"Antecedent stimuli refer to the state or condition of the environment prior to the emission of a response. There are antecedent stimuli for every response because behavior never occurs in a void. It must be emitted within some environmental context" (Cooper et al., 1987, p. 30).

Computer hardware and software have made possible a large range of antecedent stimuli (Williams, 1990). For example, hardware can convert printed text into Braille, voice synthesis technology can change written material into auditory presentations, and the ability to replay video can capture a 'slice of life' to simulate the real world.

Organisation of the module is also of particular importance. Waldrop (1984) states that "CAI modules of instruction must be systematically integrated into the entire scope and sequence of objectives for a given learning situation" (p. 40). Computers are very predictable in their operation, and can therefore carry out systematic instruction consistently across learners.

"The principle of *stimulus control* should be considered in courseware assessment. A device accomplishes stimulus control by allowing for frequent practice of the skill being taught" (Criswell et al., 1984, p. 45) Repetition of material helps with generalisation, which in turn helps with transfer of training. Computers excel at repetition, and do not tire of presenting the same problems.

"Prompting and fading refer to the procedure of giving extra help to prime the student to respond to instructional material, then as the student learns, fading the prompts until they are gradually dropped out of the training" (Criswell et al., 1984, p. 45). Computers can accurately and consistently time their prompting, and criteria for fading can be consistently applied.

Behaviour

> *"Behavior, human or otherwise—remains an extremely difficult subject matter"*
>
> *(Skinner [1969], p. 114, cited by Cooper et al., 1987, p. 31).*

"The behaviour of individuals changes through experience of their environment" (Kay et al., 1968, p. 29). After the antecedent has been presented, the learner is expected to respond and the teacher must have some way of detecting this response.

"The computer has allowed numerous ways [for the learner] to respond, and has been used for responses by the severely retarded, infants, and even sleeping subjects" (Williams, 1990, p. 35). For example learners do not need to use a regular keyboard; they can use other input devices such as modified mice, concept keyboards, light pens and touch screens, which can adapt the required response topography to the capabilities of the learner, expanding the scope for instruction and reducing alienation and frustration.

Consequences

> *"Success of CAI depends, in large part, on the application of reinforcement principles to the technique"*
>
> *(Waldrop, 1984, p. 41).*

"There is nothing inherent in CAI that ensures learning" (Waldrop, 1984, p. 41). With CAL, reinforcement can come from three broad sources: reinforcement intrinsic to using the machine, reinforcement from module content and construction, and reinforcement from sources external to the task.

Williams (1990) outlines some behavioural principles for reinforcement when using CAL. These are: learner control vs. program control, personalised feedback, sequence of mastery between modules, and external reinforcement in addition to feedback from the computer. Neglecting to plan for reinforcers can mean that learning is seriously impaired. The basic premise should be that a person's future responses are dependent on the consequences of previous responses (Waldrop, 1984).

Reinforcement Intrinsic to Using the Machine

"The use of computers has seemed almost addicting and has usually provoked student interest" (Williams, 1990, p. 37). This reinforcing property is destined to increase

given the rapidly increasing capability of microcomputers in such areas as graphics, color, and animation (Waldrop, 1984).

However, certain problems do arise. For instance the computer is becoming more and more common place in our society, so people are more familiar with the computer now (through video games and TV). "One might expect that as novelty decreases, so does the inherent reinforcing properties of the machine" (Waldrop, 1984, p. 39). People are not only more familiar with the computer but expect more from CAL. Care needs to be taken to not rely too heavily on the "tricks" of the computer to hold the learner's attention (Waldrop, 1984). "This places a heavy burden where it rightly belongs—on the content and structure of the CAI" (Waldrop, 1984, p. 39).

Reinforcement from the module content and construction

It is important to build a CAL system that allows mastery of the content, helping the learner experience the "joy of learning". This means that the learner perceives themselves as increasing in competency.

"To hold a learner's attention until mastery occurs, however, is the more basic problem with which CAI practitioners must be concerned" (Waldrop, 1984, p. 39). Waldrop outlines some design features need to be adhered to for the program to ensure positive reinforcement rather than punishment. These are:

Learner Control This is frequently perceived as being when the learner controls how long they spend on a module. However, this means that the learner can leave the learning situation before they have mastered a skill, so a balance needs to be maintained.

Program Control Modified program control maintains the integrity of the instructional goals and objectives. To illustrate, "Once the student begins working a module, however, he or she must complete the entire module. That is, the module may not be exited prior to completion, and material may not be skipped within the module. Beyond those guidelines the learner controls that rate of progress through the module" (Waldrop, 1984, p. 39). Modified program control could impose remedial sections and review, and branching into new areas.

Writing Style

Text on a screen may not be any more reinforcing than text in a book. Therefore every effort should be made to make the modules interesting and enticing to the learner (Waldrop, 1984).

Feedback

"This area is perhaps the most closely allied with the concept of reinforcement and should, theoretically, be of prime importance in ensuring learner response" (Waldrop, 1984, p. 40).

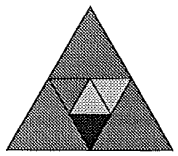
Feedback should be well timed and informative. Feedback should only be given after a learner response. Waldrop (1984) also believes that feedback should be personalised (e.g., using the learners name) and be specific (if a response is wrong, corrective knowledge/action should be presented in the feedback). There are an infinite number of ways to say that the learner's right or wrong, therefore every feedback frame should be different, to maintain learner interest.

Reinforcement from Other Sources

"Experience suggests that many students involved in CAI derive reinforcement from learning a skill (interaction with computers) that is being seen as more and more essential in society" (Waldrop, 1984, p. 41). CAL can also provide an internal comfort as it involves "the non threatening practice capability of CAI" (Waldrop, 1984, p. 41). That is, no-one is looking at the learner when mistakes are made, which removes threats of disapproval and diminished status.

1.4.3.4 Summary

"Only when computer usage is located within a discourse of educational theory that focuses on the nature of knowledge, teaching and learning will we be in a position to use this powerful technology in an educational way" (Hodson, 1992, p. 43). For the application of CAL systems to behaviourally based learning to be effective, designers should consider three factors : the teaching context, the teaching environment, and the systems relationship to behavioural learning theory. The challenge is to move from the point of believing in the best practices to fully implementing those practices in which we believe (William et al., 1990). The steps that have been taken to account for these guidelines are described in the method (*section 3*).



1.5 Money Skills and people with IH

"The goal of education should be nothing short of the fullest possible development of the human organism."
(B.F. Skinner)

1.5.1 The Need for Community Skills Training

As the movement of people with IH from institutions to the community continues, the need for community skills for these people grows along with it. Many of the people with IH who are leaving institutional life to live in the community are doing so as adults and are suddenly exposed to many social settings where the majority of people are not IH (Wheeler, 1980).

Individuals who are IH need to be prepared to function as independently as possible in the community (Martin et al., 1982). Some people who are IH have been placed back into hospital care due to inappropriate behaviour in public! (Nihira et al., 1975). Skills which have received a great deal of attention in the literature are employment-related skills, ranging range from telephone answering skills for receptionist positions (Karen, Astin-Smith & Creasy, 1985) to packing cutlery into plastic bags (Ackerman & Shapiro, 1984) at a sheltered workshop. However, it is now thought that "becoming fully independent in one's place of residence can be as important a training priority as becoming fully independent in one's work" (Boyan, 1978, p. 208).

The emphasis for teaching needs to be on day-to-day skills. "There is now a growing literature base which suggests a need for curricula and service delivery models which emphasise preparation for adult life within the community" (William, et al., 1990, p.120). There is a move away from mental age tasks to chronological age tasks to meet the demands of normalised environments (Gaule, Nietupski, & Certo, 1985).

For an person with IH "to attain the goal of optimum functioning, it is important to recognise that the skills required for full participation in community life vary markedly. These skills change over time and are particularly influenced by local conditions and factors, varying across cities and people" (Parette, 1991, p. 165).

Some basic independent living skills pertain to functional, situation-specific behaviours which are applied in a single setting and intended for the performance of a

specific tasks which occur with some regularity. "Some of these include grocery shopping, banking, budgeting, and transportation" (Browning & White, 1986, p. 237). Other skill areas important to the success of deinstitutionalisation are: personal maintenance, communication, community utilisation, clothing care, food preparation and money skills (Martin et al., 1982).

There are also life enhancement skills which are generic in that they are applicable across situations and settings, for example, "problem solving" skills. "These cognitive processes differ from the more behavioural, more physical independent living skills in that they are usually not observable activities" (Browning et al., 1986, p. 237).

1.5.2 *Money Skills*

"Far from being the root of all evil, the introduction of money is a vital step in the progress of mankind from primitive to developed life" (Rosenberg, 1973, p. 10).

One important life-skill is the ability to handle money (Frank & McFarland, 1980). This is because many community interactions involve payment for goods and services, the ability to use money as a medium of exchange appears to be an obvious and essential community survival skill. For an IH person, exercising newly acquired rights to live in the community is, at best a difficult task. Close et al. (1981), in a paper examining community-adjustment factors, reported that the ability to manage money facilitated successful community placement for people with IH. It has been stated that the inability to manage money resulted in cash-flow problems or even uncontrolled debt for many IH individuals placed in the community (Martin et al., 1982). If an IH person can use money, then this may provide opportunities to use other community facilities, such as swimming pools and restaurants. Money skills may make social interactions more comfortable for people with IH (Martin et al., 1982).

Brebner et al. (1980) reiterate the view that "the most important sets of social survival skills needed by people with IH, when they have to support themselves in the community, relate first to money handling and secondly to reading" (p. 6). They also state that "arithmetic should be 'social arithmetic' centred around money handling and shopping" (Brebner et al., 1980, p. 1).

1.5.3 *What sort of Instruction?*

Appropriate instruction for people who are IH has become increasingly important in recent years (Mastropieri, Bakken, & Scruggs, 1991). If we are concerned about

improving the functional levels of intellectually handicapped people, then we must look hardest at training programmes. People do not become normal by simply being placed in a normal environment; "They do not acquire new skills by osmosis" (Webb, 1986, p. 93). However, the complexity of modern life has made independent living skills a more and more intricate area for training.

"If we mean what we say about residential, vocational and recreational and social integration and normalisation, then we must set up and maintain the training programmes by which these objectives can be achieved" (Webb, 1986, p. 93). Programs for handicapped students "should arrange for the acquisition and performance of many of the skills necessary to function as independently as possible in a wide variety of current and subsequent natural environments" (Wheeler, Ford, Nietupski, Loomis & Brown, 1980, p. 45).

However, "research indicates that the majority of special education students are not being prepared to live and work in their community" (Fredrick-Dugan, Test, & Varn, 1991, p. 381). The next section briefly looks at seven studies which do look at money skills for people with IH.

1.5.4 Review of Related Research

There are many studies which examine methods to teach money skills to people who are IH. *Table 1-3* outlines a selection of these. The studies have been classified according to age and number (#) and intelligence subjects, experimental design, training method, tasks, whether they tested transfer to the real world (TT), and their conclusions.

The studies fell into three main task categories: shopping skills using a pocket calculator, making supermarket shopping lists and choosing items and coin and banking skills:

Authors	Year	Title	Age	#	IQ	Design	Teaching Method	Skill	TT	Conclusion
Nietupski, Welch & Wacker	1983	*Acquisition, Maintenance, and Transfer of Grocery Item Purchasing Skills by Moderately and Severely Handicapped Students*	19-21	16	moderate -severely IH	SS MPD across subjects	D&P with prompt cards	Using a Calculator to help buy groceries	Yes	IH can be taught to use picture prompts and calculators to make purchases, and limited generalisation
Gaule, Nietupski & Certo	1985	*Teaching Supermarket Shopping Skills Using An Adaptive Shopping List*	17-20	3	moderate -severely IH	SS MPD	D&P in real environment	Make a shopping list, find and purchase items	Yes	Shopping skills can be taught and maintained
Hare	1980	*Classroom Techniques*	5-13	100	$\overline{X}$ = 72.9	Group	one-on-one varied instruction	Coin skills	No	Coin skills
Wheeler, Ford, Nietupski, Loomis & Brown	1980	*Teaching Moderately adn Severely Handicapped Adolescents to Shop in Supermarkets Using Pocket Calculators*	13-17	7	38-53	SS	one-on-one in simulated supermarket	Make a shopping list, find and purchase items	Yes	Moderate and severe IH can be taught to buy items from a supermarket
Young, Baker & Martin	1990	*Teaching Basic Number Skills to Students with a Moderate Intellectual Disability*	8-10	5	35-54	SS MB across subjects	Discrimination Learning Theory vs Direct Instruction	Arithmetic	No	DLT succeeded where DI failed
Frederick-Dugan, Test and Varn	1991	*Acquisition and Generalization of Purchasing Skills Using a Calculator by Students who are Mentally Retarded*	18-20	2	36,40	SS MP across subjects	One-on-one drill and practice	Using a calculator to total prices	Yes	Skills were successfully taught, transferred and were maintained
Shafer, Inge & Hill	1986	*Acquisition, Generalization, and Maintenance of Automated Banking Skills*	25	1	46	SS MPD across behaviours	Modelling and practice on simulation	Bank depositing skills	Yes	Skills were successfully taught, transferred and were maintained

Table 1-3: Research on Money Skills and people who are IH

1.5.4.1 Shopping skills using a pocket calculator

Nietupski et al. (1983) used drill and practice with picture prompt cards and calculators to teach people who were IH to purchase items at a supermarket. This study which used a single-subject multiple probe design across the subjects. The subjects achieved only partial generalisation to supermarkets, which the researchers attributed to the fact that the training did not address all of the skills involved in supermarket shopping (e.g., obtaining a cart and grocery item search skills). Follow up probes indicated that partial maintenance of the skills over a three month period had occurred.

Frederick-Dugan et al. (1991) used a single-subject multiple probe design across two subjects to teach pocket calculator skills for making purchases. They used a drill and practice teaching technique, which enabled subjects to rapidly acquire the skills and to transfer them successfully to the community. They extended earlier research by incorporating time-delayed prompts and general-case programming. However, the baseline data shows that subjects already knew how to use a calculator, so the instruction focussed on the purchasing skills involved rather than the calculator operation skills.

1.5.4.2 Making shopping lists and Finding Items in a Supermarket

Wheeler, et al. (1980) taught subjects to make a shopping list, find and purchase items. They used a single subject design, with 7 subjects who were trained one-on-one in a simulated grocery store. All of the subjects were moderately handicapped. Subjects were dictated a shopping list, and were required to print this out and then go to a supermarket and buy the requested items. Purchases (as in the previous two studies) were made with the aid of a pocket calculator.

Transfer of training of these skills to other supermarkets was not tested, but they suggest this for future research. Other suggested modifications include using picture prompts for items and getting subjects to circle the required items rather than having to write out what they need, as some people with IH are not able to write. Two other limitations with this study were that the subjects were only taught to purchase a maximum of thirty food items, excluding produce, meat, laundry items and other 'typical household' goods, and that the prioritising of items so that if they do not have enough money they know what they really need was not taught.

Gaule et al. (1985) aimed to teach three skills: prepare a shopping list, locate and obtain items in a supermarket and purchase those items. They used a single-subject

modified multiple probe design across skill cluster to assess the effectiveness of the training program. Three subjects were taught using a drill and practice teaching technique and an adaptive shopping aid. Feedback was given in the form of social praise for correct responses, and least-to-most prompt correction procedure for task-step errors. They found that all three subjects could acquire the skills taught. When maintenance was tested, even four weeks after training, they found that partial maintenance had occurred.

They commented that skill maintenance may have been greater if the program had been extended to the home environment, so that subjects could practice the skills learnt. However, transfer of training was not tested. Gaule et al. (1985) also state that the expense of the training was minimal as subjects only spent approximately $2.50 per visit. It appears that the number of items purchased at any one visit was quite small, which may account for the rapid acquisition of skills.

1.5.4.3 Coin and Banking Skills

Frank et al. (1980) is the only study out of the seven studies reviewed which adopted a group design to assess the effectiveness of the training people with IH money skills. The subjects were divided into two instructional groups: one-to-one tuition and small groups. They tested 100 subjects on coin skills, using these two methods of instruction. The mean IQ of subjects was 72.9, all were aged between 5 and 13 years. Results showed that coin skills are worthwhile teaching and can be taught using either method in a reasonable period of time. It was also found that subjects maintained these skills three weeks after the training took place.

Shafer et al. (1986) taught one subject bank depositing skills using both modelling and practice techniques. The subject was instructed, in a simulated environment, on the use of an automated banking machine. A simulated environment was chosen so that the subject could practice numerous times without the interruption of other customers. Also, four incorrect PIN'S would have resulted in the real machine withholding the card. A multiple probe design across behaviours was used to measure the effectiveness of training. Generalisation was tested during the training. Initial intervention showed minimal transfer, which was attributed to the screen being different in the training system from the actual machine and the lack of time constraints imposed during training, which meant that transactions in the real world were not carried out in a reasonable length of time. Once these two factors had been addressed, transfer of training did occur. The acquired behaviour had been maintained six months after the training had been completed.

Young et al. (1990) taught basic number skills to five people with moderate IH. They compared two teaching techniques: *Discrimination Learning Theory* (D.L.T.) and *Direct Instruction* (D.I.). The effectiveness of each was measured using a single subject multiple baseline design across subjects. The teaching was carried out in a natural setting using only materials available at a public school. They found that the D.L.T. model was better then the D.I. model for teaching basic mathematics skills. They state that future research could examine the individual components to the D.L.T. techniques and measure their effectiveness. Transfer of training was not assessed in this study.

1.5.4.4 Summary

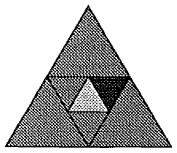
There is a need for people with IH to possess community living skills in a number of different environments, largely due to the phenomenon of deinstitutionalisation. Therefore the transfer of skills learnt should be considered a critical outcome of educational programs (Liberty, Haring, White and Billingsley, 1988).

The message from the reviewed research is optimistic: people who are IH can be taught a great deal more than was once accepted, providing that appropriate techniques are employed. In all seven studies the subjects managed to acquire money skills.

Many of the studies trained in a natural setting but didn't test transfer to other environments. Despite this the transfer of training was a pervasive theme throughout with the emphasis being placed on the necessity to plan for the facilitation and transfer of money skills.

The majority of the studies adopted strategies to help produce transfer. One such technique was employed by Fredrick-Dugan et al. (1991) who applied general case programming methods in order to select appropriate stimulus exemplars.

Many of the studies also noted that money skills are part of a wider context of purchasing skills (e.g., entering the store, getting a cart [if appropriate], locating items, checking prices and finding the money required for the purchase etc.).



1.6 CAL and Money Skills

As outlined in *section 1.4* there are very few studies which look at money skills taught using CAL. For this reason, this section looks in detail at a study by Emslie (1991) which tested a CAL system with learning disabled children.

Emslie's (1991) study was primarily based on studies by Williams (1986) and MacMillan (1989). Their research examined the use of computers in a primary school classroom. Emslie (1991) extended their work by testing if the skills learnt transferred to probe tests using real coins and hand-drawn items. Emslie stated that "the main purpose of this study was to investigate if a computer program could be used to teach children money skills" (Emslie, 1991, p. 55).

1.6.1 Method

Age of subjects	7-8 years
Number of subjects	Five chosen from 75 pupils who participated in a preliminary money skills paper and pencil test.
Educational Level	All were classified as learning disabled.
Setting	Primary school classroom, during mathematics lessons.

The five subjects were chosen as they received the lowest scores ($\overline{x} = {}^{8.8}/_{25}$) for the money skills test. This preliminary test was given during a mathematics period in a group. All participants were students at a small non-urban primary school in the Waikato province.

1.6.1.1 CAL System and Instructional Design

Design	Multiple baseline across subjects.
Type of Software	Custom.
Type of Hardware	Commodore 64 computer with a colour screen and a standard keyboard.
Training Technique	Drill and Practice
Task	Giving correct money and working out change.

Transfer Tested transfer to real coins, but not to the real world.

Modules

The program was divided into two parts. These were:

Making Purchases 12 problems in each module, teaching one to three coin problems. Subjects needed to get 12 out of 12 twice in a row in order to progress to the next level. Problems sets got systematically harder.

Giving Change 10 problems in each module. Given one or two coins, the subject had to work out change of one or two coins. Subjects needed to get 10 out of 10 twice in a row in order to progress to the next level. Problem sets got systematically more difficult.

Software and Hardware

Screen Format The screen was divided into three sections. The left hand side of the screen had drawn coins in a box labelled "*You have*". Under this was another box labelled "*You gave*". To the right of both of these was place for a picture of an item and a price tag. The screen changed slightly for the change problems, to include a "*change*" box.

Keyboard The keyboard was a regular keyboard, with coins stuck next to the function keys. The return key signalled the completion of a purchase; the subject pressed this when they thought they were correct. The backspace key was coloured red and was used as a "*take back key*".

Feedback & Probes

Game "*Keep the wasps from the honey*".

- ❖ Arcade style game which required subjects to use a joy stick.
- ❖ Opportunity to play was presented after four problems were completed correctly.
- ❖ Scores were shown on the computer screen.
- ❖ Lasted 20 seconds or until the player was 'killed'.

Feedback *Feedback when Correct:* A plane would fly across the screen with a banner saying "*right*", and coloured balloons would drop.

Feedback when Incorrect: A plane would fly across the screen with a banner saying "*Wrong*", and a low pitched noise would play.

Probes Done at the beginning of each week, using real coins and items drawn on cards.

Follow-up Six days after the study. Rated by an independent observer with 100% agreement on all responses.

1.6.2 Results and Discussion

All subjects made slow but steady progress through the two parts of the program. The results showed that the five subjects enjoyed participating in the study and that generalisation to the use of coins in a simulated purchasing situation did occur (Emslie, 1991). All but one subject enjoyed the computer system and enjoyed participating in the CAL.

Emslie's (1991) study did not test the transfer of training to the real world. However she did state that "it is clear that probes in real life situations would have provided information for the identification of weak areas in the plan for generalisation" (Emslie, 1991, p. 58).

Emslie's (1991) feedback provided the subject with knowledge of their result (correct vs. incorrect). She found that the feedback was largely ignored until the subjects gained mastery of the system (how to operate the keyboard etc). She found that three of the subjects 'sighed' when they got an answer incorrect and spent longer working on the answers before pressing the return button.

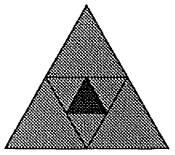
For future research, Emslie(1991) suggested that researchers could provide an example of the correct response in addition to the simple "incorrect" feedback. She also suggested that this sort of informational feedback could be combined with a game to see if the combination enhanced learning.

Emslie (1991) found that one of her subjects tired of the arcade-style game. She suggested that future research could change the game, to vary the reinforcement. It appeared that because he didn't like the game, this subject was reluctant to use the system.

The screen format used by Emslie (1991) was adopted for this study, as it was both clear and simple, but it was modified slightly to simulate pushing money across a counter. This study also combined the paper-and-pencil money skills and simulated purchasing tests that Emslie (1991) gave to her subjects. The combination of these provided the researcher with a pre- and post-test to assess if there was any

improvement in the subjects money skills, independent from the intervention and testing in the real world.

This study extends Emslie's (1991) by testing transfer of training to actual purchasing situations and providing informational feedback (correct answers for problems when subjects were incorrect). It also extends the study by using a money keyboard to reduce the coding required of subjects, in order to avoid the preliminary attentional difficulties noticed by Emslie (1991). In order to help with generalisation, the system developed for this study also extended the media Emslie (1991) used to include real pictures, animation and sound. The division of modules also differed in this study from Emslie's (1991) as two coin problems were divided into simple (e.g., $1.20) and complex (e.g., 40¢) tasks, making each task smaller and more attainable. In addition to Emslie (1991) three different prompts were also used to help the subjects learn the different ways prices of items may be presented in the real world (varbal, verbal+price tag and price tag only prompts).



1.7 Money Skills, CAL and people with IH

There is little research on teaching money skills using CAL to people who are IH. The only study known to the researcher are by Brebner et al. (1980), Hallworth and Brebner (1980) and Hallworth, Brebner and Brown (1980). They started their work at the University of Calgary using CAL in 1969, opening a special unit for people with IH in 1971. The unit was called the Calgary Vocational and Rehabilitation Research Institute (VRRI). They stated that main purpose of the institute was to help people with IH become self supporting and integrated members of the community (Hallworth & Brebner, 1980).

The unit ran many programs at any one time, with approximately 250 trainees, from within the institute. Each CAL course had about one hundred people enrolled. People with IH worked on the computers for half hour sessions.

The three papers that describe their research are all anecdotal in nature, so this summary is presented in a similar fashion. Each paper gave a brief account of their work teaching both reading and money skills. The review presented here concentrates on money skills.

1.7.1 Method

Selection of subjects was based on whether the skill was "relevant to the experience and interests of the trainees, and lead to the acquisition of those "social' survival skills" which they will need for daily life in the community" (Hallworth et al, 1980, p. 2).

Age of subjects	16-50 years (most were 18-24 years)
Number of subjects	100
Educational Level	Moderate to severe IH

1.7.1.1 CAL System

Brebner et al. (1980) designed their CAL system around the notion that a satisfactory interface must be portable, reliable and flexible. The exact configurations of their system depended upon, who was using it and what skills were to be taught, therefore there were a number of special input and output devices. The input devices were aimed

less at overcoming physical handicaps than at facilitating learning by eliminating some of the superfluous mental processes required for interaction (e.g., a money keyboard for money skills). These are listed below:

Type of Hardware
- ❖ CRT or hard-copy terminal
- ❖ DEC 11/70 computer
- ❖ Microprocessor with a 8080 chip
- ❖ S-100 bus (with space up to 21 boards)
- ❖ Number pad
- ❖ Light pen
- ❖ Touch sensitive display
- ❖ Expanded keyboard
- ❖ Money keyboard
- ❖ Double sized characters for the partially sighted
- ❖ Animation
- ❖ Colour
- ❖ Synthetic speech
- ❖ Control of random access slide projector (17" CRT monitor)
- ❖ Speaker
- ❖ Special graphic characters

Type of Software Custom. 80 modules written in DEC BASIC-PLUS.

Brebner et al. (1980) stated that the microprocessor-based terminal proved invaluable for the CAI project with developmentally handicapped students.

1.7.1.2 Instructional Design

Modules

Their system had 80 modules which progressed from counting problems to banking skills. They believed that people with IH "need a well structured curriculum made up of small learning steps which have been carefully sequenced" (Hallworth et al, 1980, p. 2). Responses were recorded, and programs had to be mastered to criterion before proceeding to the next task. The sequence of modules were organised so that people could enter and exit at the appropriate level of difficulty.

Feedback & Transfer

Feedback Reinforcement was always immediate, and in a standard format which trainees could easily understand (Hallworth et al, 1980). For example, a large tick or a beep was used when responses were correct.

Transfer Transfer was tested in simulations of real life situations, such as simulated purchase with real articles and money changing hands between a tester on one side of a table and a trainee on the other (Hallworth et al, 1980). However they stated that "more extensive work on such transfer is required, preferably including behavioural data" (Hallworth et al, 1980, p. 3).

They did not test transfer to the real world.

1.7.2 *Discussion*

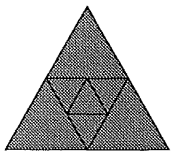
They outlined a number of factors to be taken into account when designing courseware:

- Programs should be written so as to minimise the load on short term memory; for example, by ensuring immediate feedback so that subjects do not lose track of the problem.
- Related to the suggested deficiency in short-term memory, is that many learning difficulties of people with IH arise from an inability to perceive and attend to relevant stimuli; and that once they do attend, their learning is strictly comparable to that of other persons.
- Over learning is necessary in order to ensure retention. This involves a great deal of repetition
- Visual images should frequently be used instead of words as too many words confuse people with IH.
- Multimedia is vital. "Image projection is essential, audio output is desirable, large characters and graphics are useful" (Hallworth et al., 1980, p. 3).
- Motivation is an important factor, as people with IH often find learning a negative experience. "It is therefore essential that they meet with immediate success and receive immediate reinforcement" (Hallworth et al., 1980, p. 2).

They stated that "the general conclusion from the project is that, provided the programs are written in accordance with what is known regarding their learning, and using appropriate multi-media terminals and special input devices, CAI for the developmentally handicapped is effective" (Hallworth et al., 1980, p. 3).

The CAL system developed for this study tries to stimulate the subject, and simulate real life situations. Many of the practices outlined by Brebner et al. (1980) were adopted in this study, as the benefits had been demonstrated by them and many other studies since (see *section 1.4*). These include immediate feedback, repetition of problems, an emphasis on visual stimuli rather than spoken words, the use of multimedia, and attainable success. The CAL system used in this study benefited greatly from the simultaneous use of several high quality media, which have now been integrated into off-the-shelf products, unlike the expensive custom devices used by Brebner. A money keyboard was also used in this study to reduce coding and help the subjects to attend to the relevant material.

This study extended Brebner et al.'s. (1980) as it tested transfer to the real world. It also provided the subjects an explanation of the correct answer, if they were incorrect on their first and second attempts.



1.8 *Rationale and Aim of this Research*

"Tests of different generalisation should extend over a number of different environments. Future research should plan to investigate this area"
(Emslie, 1991, p. 58)

IH & Money

Many persons with IH in New Zealand have moved from institutions into community care facilities, following the international trend of deinstitutionalisation. As a result of this movement there are numerous training programs in place to teach such people those skills that enable them to function competently within the community. A number of studies have indicated that money skills are socially useful and directly benefit the individual. Possessing these skills enable the person with IH to use more community facilities (e.g., swimming pools, shopping malls, and restaurants). If IH people can not learn these basic skills, they are at risk of being placed back into institutions.

This study was designed to teach people with IH coin combinations for prices of common items (e.g., milk or a chocolate bar). Training was restricted to coin usage, as larger transactions are still often handled by care-givers.

CAL

There is a large body of empirical evidence which indicates that there are advantages in using computers as instructional tools. "However most past research on CAL has been concerned with children and adults who are mentally and physically normal" (Ryba, 1982, p. 4). Brebner et al, (1980) and Emslie (1991) taught money skills using CAL to people with IH and with learning disabilities (respectively). This study is based on their work.

Concept keyboard

Brebner et al. (1980) comment that many people with IH have limited co-ordination and physical abilities. They therefore used a concept keyboard which was built to maximise the concentration of the subjects by minimising the amount of coding required in their response. This study built a specialised keyboard, which replicated the Brebner et al. (1980) study, and extended Emslie's (1991) system.

Multimedia

This research uses multimedia (incorporating pictures, animation, speech and sound). Many people with IH are unable to read, therefore "to teach money handling...it is essential to have high quality image projection in order to illustrate coins, bills, and items to be purchased" (Brebner et al., 1980, p.3). Simple, succinct audio output is also desirable when teaching people with IH. This study capitalises on technological advances since Brebner et al., (1980) study which allow the integration of different media into one machine. The establishment of multimedia standards, and the competitive multimedia market both benefit the developers of CAL software.

This extends Emslie's (1991) study which used low-quality drawings and very limited sound. It also extends Brebner et al.'s (1980) study as it is more flexible and portable than their cumbersome system.

The realism incorporated in this CAL system was chosen as it provided natural antecedents and reinforcers, helping transfer of money skills to actual purchasing situations. The stores and items to be purchased changed throughout modules providing many different stimulus examples in the teaching setting (Cooper et al., 1987).

General Features

Throughout the program didactic procedures are avoided and verbal instructions kept to a minium. Modules are sequenced to progress from simple to difficult problems. All of the material was aimed to relate to adult interests. All of the assessment procedures, computer software and the concept keyboard were designed specifically for the instruction of money skills.

Transfer

When CAL programs are evaluated, a critical factor to be taken into account is the amount of transfer of the skill from the program to a real life situation (Liberty et al., 1988). Westling and Floyd (1990) state that transfer occurs when people do what they are trained to do in another setting other than the original one.

"Now the application of an educational technology such as computer-assisted learning remains uncertain—even where the research has been done, the results are very ambiguous" (Hooper, 1990, p.5). "Although there are a number of articles concerning the use of the microcomputer with special populations, there is relatively little research being done on the effectiveness or impact of such use" (Howell et al., 1987). What Stokes and Baer (1977) refer to as 'train and hope' is a common approach used throughout the CAL studies. That is, programs do not actively incorporate instruction that is directly aimed at generalisation of aquired skill across various time and setting variables. Emslie (1991) and Brebner et al. (1980) state that there is a need to test the transfer of money skills taught using CAL to the real world to test the usefulness of programs. "Tests of different generalisation should extend over a number of different environments. Future research should plan to investigate this area" (Emslie, 1991, p. 58). There is a need for quantitative data, as many studies assume that transfer will take place.

The overall objective of this research was to ascertain whether people with IH can transfer what they have learnt from the CAL system to the 'real' world. To facilitate transfer, all modules had pictures of real stores, real shopkeepers and recorded voices to give prices of items.

1.8.1 *Experimental Design*

Fundamental to the methods applied throughout this research, the experimental design used. The research question was:

Do basic money skills taught to IH adults using CAL transfer to actual purchasing situations?

To answer this question, the experimental design needed to satisfy the following criteria:

1. Able to measure effects across subjects who were selected from people with IH living in the community.
2. Promote learning in individuals.
3. Able to show a high degree of internal validity, between the CAL to teach basic money skills and the transfer of this skill to actual purchasing situations.

There are many different experimental designs. Traditionally in psychology, the effects of an independent variable are compared across groups of subjects. However, such group experimental designs can miss effects on individuals; subjects improve to varying degrees and important sources of variability can be lost (Cooper et al, 1987).

Education is ultimately about individuals, so designs for educational research look at effects on individuals. That is, the variables responsible for one subject's improvement must be discovered (Cooper et al., 1987). Single-subject experimental designs are concerned with the behaviour of individuals, so this design was adopted for this research. The greatest strengths of single-subject experimental designs is the convincing demonstration of a functional relationship made possible by replication within the design itself (Cooper et al., 1987). Most previous research teaching money skills to people who are IH use single subject designs (see *section 1.6*).

There are many different single subject designs to choose from. This research used a multiple probe design (MPD). The MPD allows intermittent measurements (probes) to provide the basis for determining whether behaviour change has occurred prior to intervention. This is useful, as improvement from one set of problems (eg. simple two coin problems; \$1.20¢) to the next level (e.g. complex two coin problems; 30¢) was unlikely to be learnt before the acquisition of the preceding component. The MPD provided internal validity controls necessary to validate the instructional procedures, without having to collect repeated baseline measures. Extended baseline measurement

as used in other single subject designs were unsuitable as probes were both expensive and the implementation of large numbers of probes would have been impractical.

According to Cooper et al. (1987), the MPD, when applied to a sequence of behaviours that are to be learned, provides answers to four questions;

> ❶ What is the initial level of performance of each behaviour in the sequence?
>
> ❷ What happens when sequential opportunities to perform each step in the sequence are provided before training on that step?
>
> ❸ What happens to each step as training is applied?
>
> ❹ What happens to the performance of untrained steps in the sequence as criterion-level performance is reached on preceding steps?
>
> (p. 210)

Westling et al. (1990) stated that extensive training in one setting may inhibit generalisation to other settings. For this reason, probing in multiple settings was an integral part of this program. The stores were varied in terms of location, nationality, gender of the shopkeepers, and the level of activity in the store, in order to vary the stimuli being presented to the subjects.

A MPD was appropriate for this study, as it allowed the researcher to ascertain if money skills were acquired as a result of the CAL and the probes permitted the question of whether money skills transferred to the real-world to be answered.

Method

The purpose of this section is threefold:

1. To present the tests used for subject selection, assessing subjects prior to and post CAL.
2. To present the measures that were used to assess learner performance on the CAL program and their ability to transfer this to 'actual' purchasing situations.
3. To describe the software and hardware that was developed for the CAL to teach basic money skills.

Outline

Educational practices highlight the importance of multiple and comprehensive assessment measures, as well as multi-dimensional and clearly defined criteria. Taking these considerations into account, the structure of the study was as follows:

Subject Selection:

- Needs Assessment Questionnaire (APPENDIX B)
- Compilation of Subject Details (APPENDIX C)
- Activity Preference Questionnaire (APPENDIX D)
- Money Skills Test (APPENDIX E)

Pre-intervention:

- Observation in 'Actual' Purchasing Situations (APPENDIX F)
- Computer Aptitude Test
- Letter about Subject Involvement & Ethics Form (APPENDICES A & O)

Intervention:

- CAL System
- Data Collection and Analysis
- Probes 'Actual' Purchasing Situations (APPENDIX F)
- Activity Preference Questionnaire (half way) (APPENDIX D)
- Letter to Primary Care-givers about Subject Progress (APPENDIX K)

Post-intervention:

- Activity Preference Questionnaire (APPENDIX D)
- Money Skills Test (APPENDIX E)
- Observation in 'Actual' Situations (APPENDIX F)
- Social Validation/Acceptability Questionnaires—C (APPENDIX M)
- Social Validation/Acceptability Questionnaires—S (APPENDIX N)
- Thank You Letter to Subjects & Primary Care-givers (APPENDIX L)

The method adopted in each of these sections is explained below.

2.1 Subject Selection

"Prior to the provision of many types of technology for persons with mental retardation, one or more evaluations are typically conducted in a number of domains"

(Parette, 1971, p. 171)

Subject selection for learning money skills by CAL was based on four procedures outlined in Cooper et al. (1987, p. 37):

- interviewing significant others
- interviewing the subject
- testing the subject
- directly observing the subject

Subjects answered one questionnaire/test for the first three procedures and significant others answered two questionnaires.

2.1.1 Interviewing Significant Others

"Without the assistance of parents, siblings, teacher aides, and staff, many behaviour change programs cannot be successful"

(Cooper et al., 1987, p. 39).

Investigating community providers' perceptions about the adequacy and need for training is one practice that William et al. (1990) stated was important in educational research. A great deal of the literature indicates that the methodology for applied research with small numbers of individuals must be broadened to incorporate multiple skills across several subjects, including those individuals commonly excluded from research efforts, for example, neighbours, work supervisors, and co-workers. This research has tried to do this.

Initially the researcher approached the Hamilton Central Branch of The Society for the Intellectually Handicapped (IHC)—a national organisation. The research proposal was presented and discussion ensued about the needs and availability of people with IH who were covered under the IHC umbrella. From this initial meeting and other meetings with the Branch manager and a service group manager, a list of about twenty clients to contact was obtained. This list provided the basis for the subject selection. These twenty potential subjects were all adults residing in community living groups with IHC. After telephoning the subjects' primary care-givers and being unable to contact some people, the list was narrowed down to sixteen people with IH for preliminary interviews.

Additional information about subjects was obtained using when, what and how questions.

2.1.1.1 Needs Assessment Questionnaire
(APPENDIX B)

Origin	Cooper et al.(1987)
Modifications	Seven point scales were used, as well as 'yes' & 'no' questions Six questions were asked instead of nine The questions were reworded
Purpose	To determine the social significance of money skills for subjects To check the behaviour to be taught is for the benefit of the subject, rather than others To check both short and long-term natural reinforcers.
Format	Questionnaire (APPENDIX B) Scale or 'yes'/'no' response required Room for elaboration/comment provided
Setting	Chosen by the person answering the questionnaire
Materials	Questionnaire (APPENDIX B) Pen/pencil
Procedure	Presented to each care-giver Filled out in their own time
Preparation time:	Two minutes
Time to complete:	Fifteen minutes
Questions	Six—about the needs of subjects with respect to money skills
Recording & Grading system	Responses were not graded—looked at in relation to the other tests and questionnaires results.
Learning Context (Section 1.5.1)	Home-teaching partnership Integrated delivery of services Systematic program evaluation

All care-givers were asked to fill out the questionnaire (APPENDIX B) in their own time without consulting others. The form began by saying;

"Any additional information you may have would also be appreciated".

The aim was to ascertain whether primary care-givers thought that subjects needed and would benefit from money skills. The questions covered what opportunity subjects may have to use money, whether they could already deal with small amounts of money knowledgeably, and if not, how the skill would open up avenues to the subject and whether subjects would receive reinforcement from having this skill.

The information acquired by this questionnaire was weighed against the other tests, to identify subjects who would benefit most from learning money skills. Subjects would only be selected to learn money skills "...when it can be determined that the behaviour is likely to produce reinforcement in the subject's post-intervention or natural environment" (Cooper et al., 1987, p. 45). In addition to gathering this information, it was also a means of generating a home-teaching partnership and trying to integrate with other available services.

2.1.1.2 Compilation of Subject Details
(APPENDIX C)

Purpose	To provide an overall picture of the ability of potential subjects To ascertain if they were on any medication which may slow down responses. The CAL program is recording response times. To find out the educational history of subjects
Format	Table Eight sections (eg. Medication) and room for elaboration/ comment provided
Setting	Chosen by the person answering
Materials	Questionnaire (APPENDIX C) Pen/pencil
Procedure	Presented to Managers of subjects Filled out in their own time
Preparation time:	Two minutes
Time to complete:	Fifteen minutes
Questions	Six—about the physical, educational and medical background of subjects
Recording & Grading system	Used informally to evaluate suitability of subjects
Learning Context (Section 1.5.1)	Integrated delivery of services Systematic program evaluation

A questionnaire (APPENDIX C) about subjects' IQ, medication, educational history and other personal details was given to each of the subjects' service group managers at IHC Hamilton Central Branch. Managers needed to complete these forms, as some of the information in the files is considered 'confidential' and neither the researcher nor any staff were able to access subject files. The questionnaire was in the form of a table and managers were asked to complete each section of this table.

The information required for this was considered important as the researcher needed an overall picture of the ability of potential subjects. If their IQ was too low, then they would not be included in the training as mildly handicapped subjects were preferred. Also, it was important to know if subjects were on medication which may slow down responses, as the CAL program was recording response times. Therefore medication may also account for some subjects needing more drill and practice than others. Information on medical problems was needed to help ensure subject safety while at the University (eg. if a subject was an epileptic, the researcher would ensure that an administrator was in the room during all of the CAL, in case they had a seizure).

2.1.2 Interviewing the Subjects

Behaviour analysis relies on direct assessment measures. However, "clients are sometimes asked to complete questionnaires or needs assessment surveys prior to or during the first interview" (Cooper et al., 1987, p. 38). Questionnaires are useful for identifying potential target behaviours, which can later be rejected or verified by observation.

2.1.2.1 Activity Preference Questionnaire
(APPENDIX D)

"Academic tasks should of course be relevant to the interests of learners"
(Lai, 1992, p. 11)

Origin	Karen et al.(1985)
Modifications	Fewer options to learn telephone skills (Karen et al. (1985) intended to teach this skill) Includes money skills Five options to choose skill, rather than four Administrated orally rather than written
Purpose	To determine social validity of teaching money skills beyond that determined by the care-giver requests A measure of each subjects level of motivation for learning money skills
Format	A paired-comparison format was used; subject preferences for various activities were determined by giving them a choice between two activities
Setting	At the subjects home In the dining room *or* the subjects bedroom Alone Lighting and ventilation was always good.
Materials	Administrator Test questions (APPENDIX D) Pen/pencil Tape recorder (optional) Video recorder (optional)
Procedure	Presented orally The question was asked and each task substituted into the appropriate place
Preparation time:	Five minutes (photocopying & arranging meetings etc.)
Administrator(s):	One
Subject(s):	One (more if wished)
Time to complete:	Five-ten minutes
Questions	Twelve
Recording & Grading System	The score on any given presentation of the questions was the total number of choices for learning Money Skills Five is the highest possible score.
Learning Context (Section 1.5.1)	Social integration Curricular expectations Systematic program evaluation

All subjects were given the *Activity Preference Questionnaire* (APPENDIX D). The researcher administered the questionnaire, visiting each subject in their own home, each in the afternoon. The researcher explained the questionnaire, indicating that it was;

"...just a questionnaire, and that there was no right or wrong answer, it was their honest opinion that counted...".

Both the time of the start and completion of the questionnaire, the date and names of each subject and the administrator were recorded.

The administrator would begin the questionnaire by saying:

"Hello and welcome. My name is ***name of administrator****. I'll read out two activities, and I want you to tell me which one you prefer. Please think about your answer.*

OK. let's start. If you had a choice between [task from the left] column and [task from the right] column which would you rather learn?"

Choices were presented orally by the administrator (with the same tone of voice across options; not emphasising one over another). The administrator substituted the appropriate task from each column into the question just outlined. The subject was presented choices of activities in the following order:

LEFT COLUMN	RIGHT COLUMN
sweeping out the garage	mowing the lawn
using the washing machine	**managing money**
evacuating in the case of a fire	mowing the lawn
using the phone	**managing money**
washing dishes	using the washing machine
managing money	cleaning the toilet
hanging washing on the line	using buses
using buses	**managing money**
sweeping out the garage	using the phone
washing dishes	using buses
getting groceries	evacuating in the case of a fire
use the buses properly	**use money properly**

At the end of the questionnaire the administrator said:

"Thanks for answering these questions!"

Then the subject and administrator chatted about how the subject found answering the questions, and other miscellaneous topics.

2.1.3 *Testing the Subjects*

Many standardised tests are general, and do not identify specific behaviours that are lacking. "Tests are most useful as behavioural assessment devices when they provide direct measurement of the subject's performance of the behaviours of interest" (Cooper et al., 1987, p. 39). This research adapted a test used by Emslie (1991), to assess the ability of potential subjects using money.

2.1.3.1 Money Skills Test
(APPENDIX E)

Origin	Emslie (1991)
Modifications	Items are 'real', not drawn on a piece of paper No written response is required—it is all oral & visual Prices for items to be purchased were realistic (eg. Moro Bar = $1.00) Coins were 'real' and laid out in front of the subjects, not photocopied or drawn Sixty-five questions instead of forty Presented to subjects individually Simulated transactions of coins took place IH adults vs. learning disabled children At subjects homes rather than at a school
Purpose	Gain some knowledge of subjects' existing skills and deficits with respect to coin recognition and basic money handling Ascertain each subjects ability to recognise shapes and numbers, to indicate whether they have the basic skills that the CAL assumes To determine which subjects would benefit from learning money skills
Format	Sixty-five questions: five in the first section and ten in each of the following sections
Setting	At the participant's home (this varied from a home to a flat), in their dining room or bedroom: alone The lighting and ventilation was always good
Materials	Administrator Coins (Four each of 5¢, 10¢, 20¢, 50¢, $1, and $2) Items to 'purchase' (APPENDIX E) Price tags for items (APPENDIX E) Shapes for recognition (APPENDIX E) Pen/pencil Test questions (APPENDIX E) Tape recorder (optional) Video recorder (optional)
Procedure	Presented orally Questions asked, and each subject answered
Preparation time:	Five-ten minutes
Administrator(s):	One
Subject(s):	One (more if you wish)
Time to complete:	Approximately thirty minutes (dependent on subjects)
Questions	Seven sections; • Shape and coin value recognition • Recognition of a coin from a spoken denomination • Recognition of a coin from a spoken item value • Recognition of a coin from a price tag • Selection of two coins to buy an item (spoken value) • Selection of two coins to buy an item (price tag) • A random selection of problems from earlier exercises Sixty-five questions (five in the first section and ten in the rest of the sections)
Recording & Grading system	The score on any given presentation of the questions was either out of five or out of ten
Learning Context (Section 1.5.1)	Systematic data-based instruction Systematic program evaluation Curricular expectations

All subjects were given the *Money Skills Test* (APPENDIX E).

As in Emslie (1991), there were a set number of coins to choose from for each problem, simulating a 'pocketful' of change; which varied from two coins to eight coins. In some of the questions there were two or more of the same coin (eg. 20c, 5c, $1, 20c & 50c) and in other questions each coin only occurred once. Again, as in Emslie (1991), the range of items included in the test were ones which people tend to often purchase (eg., milk, a can of coke or a pen).

The researcher of the test once again visited each subject in their own home always in the afternoon. The administrator introduced herself and then the test would begin. The time of the start and completion of the test was recorded, plus the date and names of each subject. The researcher sat opposite the subjects while giving the test. The rooms used were always well ventilated and lit. The researcher would begin by saying:

"Hello and welcome, ***name of subject****, my name is* ***name of administrator****. I'm going to teach some of you about how to use money, and I need to find out how good you are already. I'll ask you some questions, and I'd like you to answer them as well as you can. I won't tell you whether you're right or wrong until we finish all the questions.*

Do you have any questions which you would like to ask before we begin?"

"Let's begin...."

For each question, the administrator laid the coins and item to be purchased on a table in front of the subject, in the order outlined in the test. At the beginning of each section there was a statement that the administrator read out. This statement would state what the administrator was looking for. For example:

*"This (****item****) costs (****item value****). Please give me the coin you would use to buy it!".*

Subjects were asked to push what they thought were the correct coin(s) towards the administrator. If required the test administrator would repeat the question. Subjects were able to spend as much time as they wished to respond to the question. Regardless of the response, the administrator said;

"Thanks"

Subjects were not given any feedback as to the correctness of their answers until the end of all sixty-five questions. At the very end of the test the administrator said:

"We have finished the questions, thanks for answering them. Is there anything you want to ask? Would you like to know how many you got right?".

After some feedback was given, the subjects were given a choice of a food item (eg. a chocolate fish, juice, or a small packet of chips). After this, the subject and administrator chatted briefly in order to make the subject(s) feel as comfortable as possible.

2.2 Pre-Intervention Assessment

2.2.1 Directly Observing the Subject

"With direct measurement an ongoing assessment of the individuals' performance is obtained in the real situation"

(Cooper et al., 1987, p. 59)

Direct observation of subjects' behaviour is often used as an assessment measure in behaviour analysis, as it doesn't require any inferences about behaviour to be made.

2.2.1.1 Observation in an Actual Purchasing Situation
(APPENDIX F)

Purpose	To determine which subjects would benefit from learning money skills Provide a baseline for subjects who were selected for the CAL
Format	Four scenarios; • One-coin problem (eg. $1.00 for a can of coke) • Simple two-coin problem (eg. $1.10 for a 500 ml bottle of coke) • Complex two-coin problem (eg. $0.70 c for a can of coke) • Multiple coin problem (eg. $3.70 for a 2L bottle of coke)
Settings	Dairies* in the subject's area of town were chosen, as these would be the stores that they would frequent the most. None of the dairies featured in the CAL were used.
Materials	Administrator Observer to hold video and watch the video Video recorder (preferably a hand held one) Video tape Video stand (optional) 'Pocketful' of money (coins up to $2, refer to APPENDIX F) Shop/dairy Marking schedule (APPENDIX F) Pen/pencil
Procedure	Stores were notified and granted permission before the observations were to take place An observer was waiting inside with a video camera, ready to record the transactions (all were recorded) The time of day was standardised providing consistent conditions Observations were carried out during afternoon tea time (≈ 3 pm) Subjects were told before they went into the store to *"listen to the price of an item and to also **think** about their response—to concentrate!"* Subjects were prompted to go to the store and purchase an item with a known 'pocketful' of change (the amount of money varied).
Preparation time:	5-10 minutes
Administrators:	Two (one filming, one prompting)
Subject (s):	One (more if wished)
Time to complete:	Thirty minutes
Recording & Grading System	Refer to APPENDIX F for the schedule of what behaviours were expected. Small hand-held video • two observers watch the video and note behaviour and money skills off this • video provides an unbiased record of the transaction, and occurrences of appropriate behaviours are noted from the video • reduces the possibility of bias by the observer(s), and allows auditing. Shop keepers were asked the level of appropriateness of the subjects behaviour in their store—using a scale of 1 (very poor)—7 (excellent)
Learning Context (Section 1.5.1)	Systematic data-based instruction Systematic program evaluation Curricular expectations

* A *Dairy* is a New Zealand term. which refers to a corner store which sells a range of products similar to that of a supermarket.

Subjects were observed in several different stores, in 'real' (not simulated as with the money skills test) purchasing situations.

Each observation included the subjects purchasing four different items, separately. The first item was a one coin problem (eg. $1.00 Moro bar), the second item was always a simple two coin problem (eg. $1.20, for a carton of milk), the third item was a complex two coin problem (eg. 70¢, for some chewing gum) and finally, a multiple coin problem (eg. $3.70, for a *Time* magazine).

Stores were notified and granted permission for observations to take place prior to the subject going in. Outside the store, the administrator asked the subject to go inside and purchase a specified item (eg. a small bag of potato chips). Subjects were also asked, before each time they went into the shop, to give the "*exact* change" and to "*think about the problem*". The purchase took place with a known 'pocketful' of change (the amount of money varied from observation to observation, but was the same across subjects).

Observations were to be as naturalistic as possible. Observation times were selected so that they were most representative of the behaviour being observed. All observations took place at afternoon tea time (between three and four-thirty pm.)

The video allowed the researcher to see if they received any verbal and/or physical prompts from the shopkeepers. It was chosen as an unobtrusive means of gathering information, keeping the reactivity of behaviour to a minium. The time to complete the transaction, and the amount of money tendered were also recorded, and along with the prompts, were used to calculate a score out of ten (APPENDIX F).

Judgements between observers were compared and the percentage agreement was used to assess reliability; the higher the agreement the better.

2.2.1.2 Computer Aptitude Test

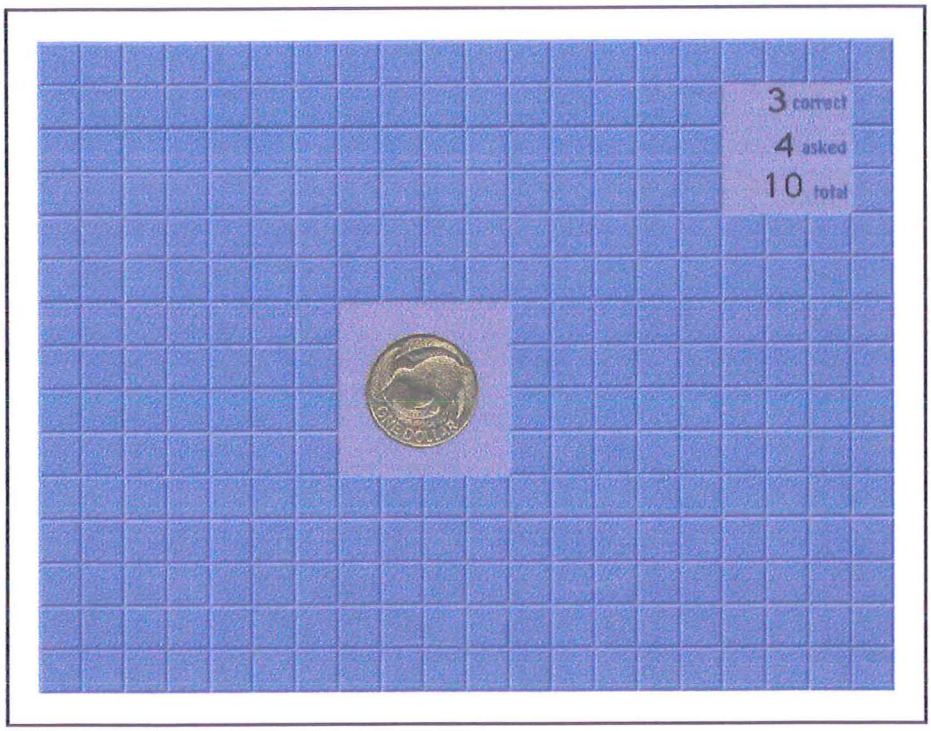
Purpose	To ascertain whether or not the 'potential' subjects were able to make the connection between the money keyboard and the screen
Format	Coins appeared on the screen and subjects were asked "*What coin is this?*". They then had to press the corresponding key(s) on the money keyboard.
Setting	CAL lab (refer to the description later in the Method)
Materials	Administrators Macintosh LC *or* better (could be a PC) Colour monitor (14 inches *or* bigger) Concept keyboard ('money' keyboard — refer to *Figure 2-4*) Tokens/rewards (optional) Video recorder (optional)
Procedure	Presented using the CAL system (refer to the description later in the Method) The question was asked and the computer waited for a response
Preparation time:	Two minutes
Administrators:	One
Subject(s):	One (more if wished)
Time to complete:	Five—ten minutes
Questions	Ten
Recording & Grading system	A log of response times & correct and incorrect responses was recorded If a subject did not get 100% then the module was worked through again Subjects were able to see their score on the screen, and were told of their score at the end of the module by the test administrator
Learning Context (Section 1.5.1)	Systematic program evaluation

A simple *Computer Aptitude Test* using the computer system developed for the CAL (money keyboard and CAL software) was administered (refer to the CAL section and the videotape for the exact software and hardware lay-out). This is a simple coin recognition exercise to determine whether subjects could make the connection between a coin on the keyboard and a scanned picture of the same coin on the computer screen. Ten questions made up this test. The test administrator explained the system to each subject prior to them starting the test, so the subject was familiar with it.

Subjects were asked "*What coin is this?*" when a picture of a coin appeared in the middle of the screen. Subjects were required to press the corresponding coin on the keyboard. If the subject was correct a large green tick appeared over the coin on the screen. If the subject was incorrect, a large red cross appeared over the coin on the screen. Verbal feedback was given during the test. When the green tick appeared, they were told "*Yes*", "*That is correct*" or "*That's right*" etc. If the subject got the answer wrong, and a red cross appeared a voice would say "*No I'm afraid that's wrong*", "*No not that time*" etc. If subjects got ten out of ten, then at the end of the test, a space-ship would fly across the screen from left to right with "*Well Done*" written on its side and an audio congratulations also played. If subjects did not get ten out of ten they had to repeat the test until they did, when the administrator thought it appropriate to stop (e.g., if the subject was not improving).

All of the subjects' responses (eg. time to answer, number of questions correct, what coin was presented, what coins were pressed, start and finish times) were automatically recorded in a log. The test administrator sat in a corner of the room for the duration of the test in case subjects had any questions and/or difficulties.

Figure 2-1: Coin Recognition Screen



2.2.2 *Letter about the Subject's Involvement and the Consent Form & Ethics Form for Subjects*

(APPENDICES A & O)

Origin of letter to Primary Care-givers	Emslie (1991)
Modifications	Gave some of the background about the researcher Told them to contact either IHC or the researcher for further information
Purpose of letter to Primary Care-givers	To inform care-givers of the purpose and procedures involved in the research To gain permission for the subject to be involved
Purpose of the Ethics Form	To inform subjects of the purpose, procedures and their role and rights if involved in the research. To gain permission of the subject to be involved.
Format of the Primary Care-givers letter	Standard business letter
Format of the Ethics Form	Standard University of Canterbury Ethics Committee Form for Subjects
Materials	Letter (APPENDIX A) Ethics Form (APPENDIX O) Administrator (to write and post the letter & Form) Pen/pencil 4 Envelopes, 2 self addressed; 4 stamps, 2 for the return envelope (if posting)
Procedure of Primary Care-givers letter	Sent to the primary care-givers of subjects by the researcher Filled-out and sent back to either place previously outlined
Procedure of Ethics Form	Sent to subjects by the researcher Care-givers were telephoned and asked to read out the form to the subjects and ask them to sign it, if they wished to be involved Filled-out and sent back to either place previously outlined
Preparation time:	Five minutes
Administrator(s):	One
Care-giver(s):	One
Time to complete:	Five minutes
Recording & Grading system	Used to obtain permission for subject involvement in the research .
Learning Context (Section 1.5.1)	Home-teaching partnership

The letter to primary care-givers and the Ethics form for subjects were sent so that "both the goals and the rationale supporting behaviour change programs are appropriately open to critical examination by the consumers (clients and their families)..." (Cooper et al., 1987, p. 43).

Subjects' primary care-givers were sent a letter (APPENDIX A) about the subject's involvement in this research. The letter was modelled on Emslie's (1991) letter to parents of the learning disabled primary school children she wanted to teach using CAI.

The letter contained information about who the researcher was (a Psychology Masters student with work experience as a community development worker for IHC over a period of two years), an estimate of the length of time subjects would be required, and an overview of what was to be taught. At the bottom of the letter was a section to be cut off and sent back to either the IHC Hamilton Central Branch or to the researcher's

home address. Parents and/or guardians were also informed that they were welcome to contact IHC or the researcher for more information about subjects' involvement, the research and/or the researcher.

APPENDIX O is a consent form for subjects to sign, stating that they were happy to be involved in the research. This was an official form, which the Ethics committee at the University of Canterbury had sighted and approved. In addition to consent being granted by the subjects, this form;

❶ Notified subjects of their right to pull out of the research at any point they wished
❷ The fact that their identity would be kept anonymous
❸ That there were no risks involved in the research.

The main data collection phase did not take place until this form was sent back.

2.3 Intervention

2.3.1 The Computer Assisted Learning (CAL) System

Origin(s)	Emslie (1991) and Hallworth & Brebner (1980)
Modifications from Emslie (1991) & Hallworth & Brebner (1980)	Money keyboard—real coins attached to it, not photocopies Coins on the keyboard were moved around, put upside down etc. Macintosh computer (LC II), rather than a Commodore 64 Scanned and videoed pictures of 'real' items & coins, not drawn No game after four correct responses No giving change section 'You have' box was not labelled No 'you gave' box Hand to push selected coins More coins used (as there are more coins in the NZ currency) Keys provided to have the item & price repeated, take back key provided, and a key when the subject is sure of their response. Problem sets = 10 questions, not twelve No banner, sound and aeroplane when subjects are correct A voice saying "Thanks", "Have a nice day" etc. when subjects are correct Different start-up screen = ABBA song, different wording (eg. "Money Skills" instead of "Maths is fun"). Entire interaction between the subject and computer is logged Not done in a classroom Colour screen Problems divided into; • One coin (eg. $1.00) • Simple two coin (eg. $1.20) • Complex two coin (eg. $0.70) • Three coin (eg. $2.15) Multiple probe design, not multiple baseline Immediate feedback on why and what was wrong if subjects made a mistake Money given and placed in a money box as a reinforcer if subjects received ten out of ten in a module Stickers used on a wall chart as a reinforcer if subjects received ten out of ten in a module Fewer modules Not using digitised speech Faster computer Images displayed by the computer in the monitor
Purpose	To teach IHC adults basic money skills using CAL
Setting	CAL lab (refer to later description)
Materials	Administrator Macintosh LC *or* better (could be a PC) Colour monitor (14 inches *or* bigger) Concept keyboard ('money' keyboard — refer to *Figure 2-4*) Tokens/rewards (optional)
Preparation time:	Two minutes
Administrators:	One
Subject:	One—Three (or more if you wish)
Time to complete:	As long as the subject wants to spend
Questions	Five per baseline module Ten per teaching module—thirty per section
Recording & Grading system	Automatically: recorded in computer text file (see below)
Learning Context (Section 1.5.1)	Age appropriate placement Integration of delivery of services Transition planning Home-school partnership Systematic program evaluation Community based training

2.3.1.1 Outline:

- Educational Goals
- Subjects
- CAL Environment
- CAL System to Teach Money Skills
  - Hardware
  - Software
- Data Collection and Analysis

2.3.1.2 Educational Goals

The goal of this study was to see if basic money skills taught to adults who are IH using CAL transferred to actual purchasing situations. The aim was to teach and assess basic coin usage to purchase items. It was not part of this research to teach other skills associated with purchasing, such as listing items to be bought and appropriate behaviour while purchasing.

2.3.1.3 Subjects:

Five subjects were chosen from the sixteen subjects who completed the pre-intervention assessment. The subjects chosen were A, F, I, M and P. All five subjects were either mildly or moderately intellectually handicapped, and were adult members of the IHC.

All subjects were able to recognise and name coins, and could differentiate between coins and between shapes (determined by the Money Skills Test). All subjects were also able to decide which task they enjoyed the most, when given two options (determined by the Activity Preference Test).

Subject A Subject A was a 29 year old woman who lived in an IHC home with full-time supervision. She worked at an IHC affiliated workshop, where her work involved bottling various substances (e.g., glue). Subject A relied on transport both to and from her job. She was able to go to the local store and purchase items for her home, if she had a list. Purchases were charged to an account at the store. A was an epileptic whose seizures were controlled by Tegretol. Subject A could do some household chores without assistance, for instance vacuuming.

Subject F Subject F was a 33 year old man who lived in a semi-independent IHC home, with part-time supervision. His home was staffed for four hours every other weekday and both weekend days. F was a cleaner and odd job man for a trucking company. He always biked or walked to work. He had a speech impediment, which meant that it was sometimes difficult to understand him. However, he had excellent motor co-ordination. He was a member of the Special Olympics Athletic Squad for the Waikato, attended dancing every fortnight and regularly played ten-pin bowls. He was also able to cook a basic meal without assistance and could use public transport.

Subject I Subject I was a 36 year old man living in a semi-independent IHC home, with part-time supervision. His home was staffed for four hours every other weekday and both weekend days. He was a cleaner at a steel company. He always walked to work. Subject I had very poor verbal communication due to poor pronunciation of words. He was also a member of the Special Olympics Athletic Squad for the Waikato and regularly played ten-pin bowls. He was able to prepare food without assistance (e.g., peel potatoes) and cook canned food and fry eggs.

Subject M Subject M was a 28 year old woman who lived in an IHC home with full-time supervision. She worked for part of the week a sheltered workshop, where her work involved bottling various substances. For the rest of the week, subject M was a clerk for the Department of Education where her tasks included franking envelopes. Subject M relied on transport both to and from her job. M was able to help with the preparation and cooking of meals in her home. She was also very capable at many household chores, and her room was always spotless and tidy.

Subject P Subject F was a 28 year old man living in an IHC home with full-time supervision. P worked in an IHC workshop assembling small mechanical devices. P bussed to and from work, which involved catching two separate buses. P had good motor co-ordination, yet chose to not be involved in any athletic activities. He was on medication (minocycline) to control his acne. He would occasionally walk to the local shop to purchase bread and milk, which was always put on an account.

2.3.1.4 CAL Environment:

"The people effects and the teaching effects are more important than the machine effects"

(Ryba, 1992, p. 95)

Ryba (1992) provided a checklist of the primary attributes to be considered when creating a learning environment for CAL. His checklist, and how this research incorporated them are presented in *Table 2-1*.

Table 2-1 Learning Environment Checklist

Checklist	This CAL system
Create socially interactive learning	Subjects came to work on the CAL in groups; they worked alone, but were able to talk throughout.
Help students to set goals for learning	At the start of each session, the researcher asked the subject what their goal was today (eg. "P, what do you hope to achieve today? or "A, how many problems sets do you plan to do today?").
Encourage and allow time for reflection	Subjects could stop and start the CAL as they wished. They were allowed to walk around, draw, have a drink and something to eat.
Reinforce correct behaviour and provide informative feedback	The CAL system gave feedback for correct behaviour for each problem The researcher also congratulated subjects when they got a question correct or finished a section etc.
Have a warm, positive learning environment	The researcher picked up and dropped off subjects for all sessions, and spent this time getting to know the subject and building rapport.
Focus on social competence	The room was small, but the furniture was arranged around the outside, so that subjects could turn inwards and chat with each other
Model behaviour for students	The CAL system modelled correct responses, and the researcher intervened when asked, or when subjects were experiencing difficulties.
Collaborate with students	The researcher would ask subjects. if they were not doing so well, what they were thinking, if they wished to stop, if they felt they were doing ok etc.
Involve your students	Allowed time for talking about the system, and answering questions.

Setting:

The lab was located on the second floor of the Computer Science Department at the University of Waikato. It was a small room, well lit and ventilated and had a warm atmosphere. This was achieved through the use of posters, lamps, colourful wall charts, warm coloured furniture(e.g. a dusky pink chair) and pot plants (refer to *Figure 2-2*). A University setting was chosen as it was a part of the community which people with IH very rarely participate. Also the labratory provided a good basis for acquiring the skills, providing a safe setting, without the distractions that may be encountered in the community.

Guidelines for what a CAL setting should be like were followed to help make the interaction with the computer as pleasant as possible for subjects. Curzon et al's. (1992, pp. 229-231) ergonomic plan was followed:

- Subjects should be seated in a stable and well supported position.
- The computer should be in front of the student, not to the side
  - so maximising the impact of the material displayed and reducing distractions
  - allowing access around the all important mid-line and helps to correct tendencies to asymmetry
- When using a keyboard, it should be approximately two inches below elbow height and well within reach, allowing the most relaxed position by the upper body.
- An ideal distance from the monitor is fifty centimetres from the users' eye and a viewing angle of 20° below the eye level.
- No glare on the screen which would impair vision—need to be able to see everything.
- Adjustments need to be able to be made easily to the height of the subject in relation to the computer and keyboard.

An ergonomically designed chair was used by the subjects—height could be altered to make the position in relation to the computer comfortable. The chair also swivelled and was on casters, which also added to the comfort of the subjects. The computer was located so that the glare from sunshine was avoided.

Figure 2-2 The CAL lab

The room specifications were:

- 3 metres x 3.6 metres
- Three pale blue/grey walls & one pink wall
- Six money boxes on the window ledge
- A poster with cartoon animals on it
- A poster with a native bird on it
- A bright purple piece of cardboard with subject names on it and provision for stickers when they get 10/10 on the CAL
- Calender (with scenes from around New Zealand)
- Three coloured pieces of paper with instructions for the Administrator on it
- Two pot-plants
- A cream desk lamp
- Two ceiling lights
- Two chairs (one grey wool & one ergonomically designed pink wool chair used by the subjects when doing the CAL)
- Two brown tables —one wood & one formica
- Macintosh LC II
- Philip's 14 inch colour monitor
- Money keyboard
- Two small black speakers
- An old dismantled Macintosh keyboard (hidden by a pot plant & the screen)
- A Macintosh keyboard
- Four ring-binders (green, yellow and two pink)

The location of each of these items is shown in *Figure 2-3*.

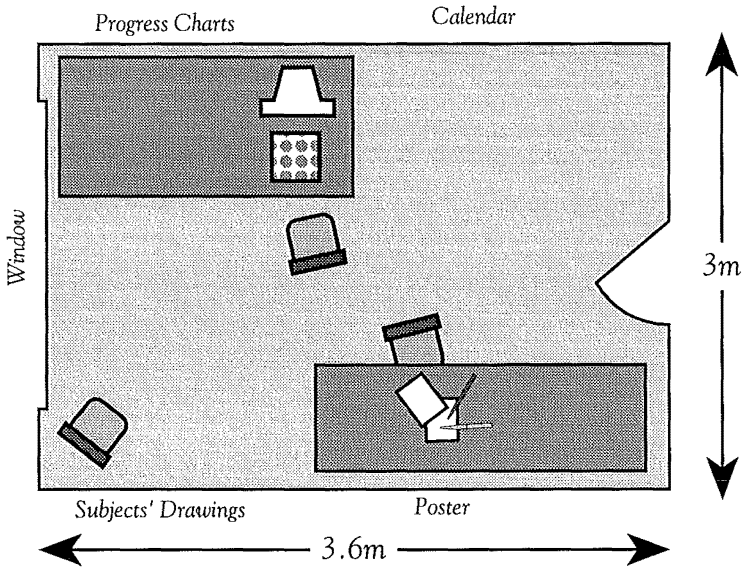


Figure 2-3: Plan of the CAL lab.

2.3.1.5 The Computer System to Teach Money Skills

Hardware Resources—development

The resources available for the development of the software represented a mid-range multimedia production system. The system was based around the Apple Macintosh, with a Macintosh IIcx, IIci and LC II being used at various times. Attached to the IIcx were a colour screen, microphone, colour printer, videodisc, CD-ROM drive, removable cartridge hard disk drive, multi-standard television monitor, four channel mixer, colour scanner and a video frame-grabber card.

The 1993 value of the equipment used for the development would be about $15 000. The 1992 value of the equipment to use the software would be between $2000 and $3000. Systems produced in *Director* can be used on the Macintosh and the IBM PC.

Hardware Resources—run-time

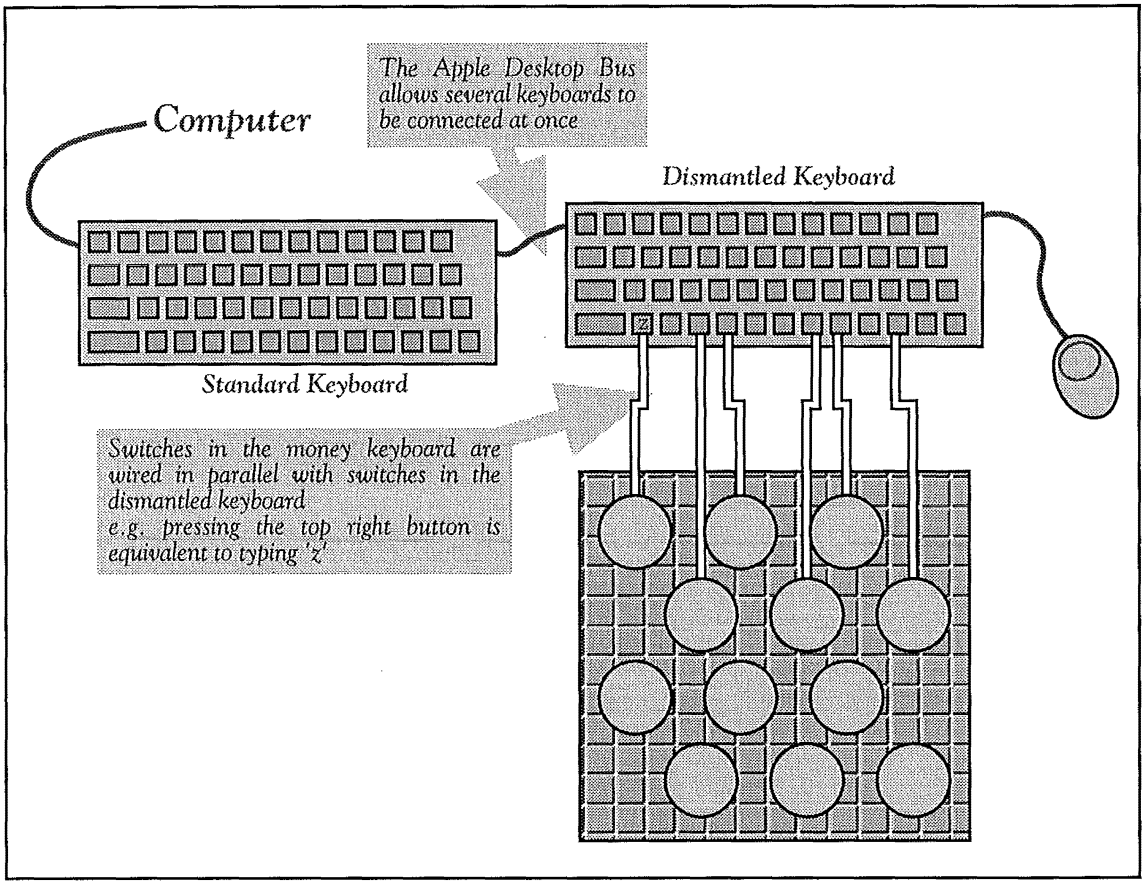
In the run-time system, input was via a 'money (concept) keyboard'. The design of the keyboard was simple and robust. The keyboard is shown in *Figure 2-4*. It was made to look as much like the screen as possible in order to reduce the coding that subjects were required to do.

Figure 2-4: The money keyboard

A design decision was made to connect the keyboard to the computer in the same way as a normal keyboard, for the following reasons:

- the normal ways to connect equipment to computers; via serial, parallel or SCSI ports, means specialised hardware, which can be expensive to develop, and dependency on certain computer systems.
- applications normally get their input from a keyboard and mouse, and would need no modification to receive input from the money keyboard if it emulated a normal keyboard.

Figure 2-5: Connection diagram for the money keyboard



The simplest way to interface the keyboard was to purchase a second-hand Macintosh keyboard, and to solder the switches on the money keyboard in parallel with the switches on the Macintosh keyboard. The second-hand keyboard was connected to the computer along with the normal computer keyboard, which could be used normally with and without the concept keyboard connected.

The second-hand keyboard cost $10. This was to be a cheap option compared to other ready-made concept keyboards available in New Zealand (these are approximately $600).

The top and base of the keyboard was hardboard, with 2 inch foam rubber in between. The switches were mounted on the base, with small holes cut through the foam rubber above each. The top piece of wood was cut using a circular hole cutter making twelve holes which would become the keys. On top of the wood was a print-out of the mauve and purple grid pattern used on the CAL screen, this was colour copied three times, cut and laminated into the shape and size of the keyboard. This laminated paper was attached using double sided tape. The coins were attached to the circles which were cut out of the balsa wood, and then covered with plain mauve laminated paper, which was cut into the shape of the keys and again attached using double sided tape. The green, red and yellow keys, were also made using coloured laminated paper. The arrows and question mark on these keys were printed on using a laser printer. The coins on the keyboard were attached with blue-tack, therefore were easily moved around the board. At various times during the CAL the coins were turned, flipped, and shifted, so that subjects did not simply learn that specific coins were always in a certain place. This was simple to do. It was felt that this would simulate a pocketful of change, hence being more like a real purchasing situation. Therefore, the keyboard was robust, easily modifiable, and inexpensive.

2.3.1.6 Guidelines used to Consider in Designing Software for CAL

"Perhaps not surprisingly, what we have discovered is that it is not the features inherent in the computer but what people do with the technology that determines its effectiveness in teaching and learning"

(Ryba, 1992, p. 86).

Cohen (1983) presents for development of CAL systems some guidelines. She also specified evaluation criteria for computer software; eighteen points generic to instructional design and seventeen specific to courseware. This research tried to take each of these points into account.

Table 2-2 lists Cohen's criteria and their implementation in the money skills CAL developed for this project. Some of her points doubled up, so these have been combined in the table below. Following this table are some of the points which are specific to behavioural CAL courseware to respond to the criticism of Williams (1990).

Table 2-2: The CAL system analysed using Cohen's (1983) guidelines

Guidelines Generic to Instructional design		This CAL System
Target audience specified	✔	adults with IH
Learner entry competencies specified	✔	Low IQ (mildly-moderate), no physical handicaps, difficulty coding, limited reading ability, ...
Rationale, goals, and objectives specified	✔	To teach basic coin usage in a realistic environment, and to measure transfer to active purchasing.
Objectives stated behaviourally		
Objectives stated in terms of learner	✔	To learn how to exchange basic money (coins) for goods and receive change
Learners informed of objectives	✔	Informed about that CAL is to teach them basic money skills, to help them buy things at the local dairy without assistance from a family or staff member
Range and scope of content adequate to achieve program's intents	✔	Coin recognition and one to three coin problems.
Pre instructional strategies used		
• Pre-tests	✔	Needs Assessment Questionnaire, Subject details, Activity Preference Questionnaire, Money Skills Test, Observation in the real world, & Computer Aptitude Test.
• Advance organisers	✘	
• Title at beginning of unit	✔	On CAL program the screen says "Money Skills" as do the wall charts
Instructional text formatted for easy reading	✘	N/A as the subjects were unable to read
Vocabulary used appropriate to learner	✔	Simple words chosen and used both in CAL and by the researcher.
		No written response needed or used
Graphics embedded into content	✔	Scanned coins and items to purchase, videoed items and purchasing situations
Graphics used appropriately	✔	Only of stores and shopkeepers and items that were to be purchased
Demonstration of the exercise provided	✔	By the researcher at the beginning and as required.
		Also given by the computer when they got a problem wrong/right.
Teacher's manual provided	✘	N/A as the researcher was the teacher.
Instructions clearly stated for student	✔	The researcher kept instructions simple and brief.
		The CAL was programmed to do the same
Evaluation components provided	✔	CAL screen had a tally of questions asked and answers in the top right hand corner of the screen, so subjects could see how they were going.
		At the end of each module their score and what module they were on appeared on the screen. If they scored 100% they had a visual clip and sound appear and a chart was filled in by the subjects to they were able to keep track of how much more they had to go etc.
Mode of interaction employed		
• Drill & Practice	✔	Money skills is a subject that lends itself to drill and practice (refer to the research design in the Introduction)
• Tutorial	✘	
• Simulation	✔	Realistic graphics
• Game	✘	
• Problem-solving	✘	
Student sequenced through the content:		
Non linear	✘	
Varied by teacher/student		
Instructional text formatted for screen display	✔	The screen showed the subjects scores and name, no other text was used as the subjects were unable to read.
Cues and/or prompts used	✔	

Action occurs on the screen	✔	Coins moved by hand when pressed, items changed between questions, feedback was given after each problem, dairy introductions were often different, and when a subject received 10/10, they had a space movie played on the screen.
User control granted to learner	✔	Could stop and start during a module if the wished, could stop at the end of a question block, could wait and think of a response for as long as they wished, able to have a go on the computer on whatever day or time they wished etc. Able to move onto other problems if the teacher felt that this was needed (this research did not however do this).
Computer-managed instruction employed	✔	
Feedback used appropriately	✔	After each answer—eg., "good" or an explanation was given of what was the correct answer
Records stored for future retrieval	✔	Logs of the interaction between subjects and the computer were taken. These logs recorded time to answer, problems number, coins given, coins used, item to be purchased, and so on. All logs were easily printed out for the researcher to analyse, if necessary.
Content designed to be altered	✔	The program chosen to create the software, was chosen so it was easy to modify. The hardware was also built so it could be used on different machines with relative ease.—keys could be changed easily.
Random generation used	✔	The coins and items were randomly generated, so that no set pattern could be learnt. (see APPENDIX I)
Packaging designed for component parts	✘	
Technical design used:		
Quick response time	✔	feedback was presented as soon as the subject answered the
Quick loading time	✔	problem, for both correct and incorrect answers.

Analysis of Courseware with respect to Behaviour Modification

Antecedent Stimuli Modules move systematically from easy to difficult problems. Allows stimulus control through frequent practice of money skills. Video and audio presentations used to simulate actual purchasing situations.

Behaviour Money keyboard facilitates responding by limiting the coding required.

Consequence *Reinforcement from the machine itself*: Realistic audio and visual material.

Reinforcement from the module content: Modified program control was used; the user couldn't exit within a module, but could choose whether to carry on at the end of each module.

Palatable presentation through realistic graphics.

Feedback was given immediately after a subject's response and an example of the correct answer was given if the subject was wrong. Numerous forms of feedback to let subjects know if they were correct or incorrect were presented.

Reinforcement from sources external to the modules: The researcher would regularly comment on the subjects performance in a module. Subjects were given a sticker and money by the researcher each time they got 10 out of 10 for a module. Subjects worked without the researcher always being present so they could gain a sense of internal comfort from not having to perform or suffer judgement every time they answered a problem.

Software Resources

The interactive, multimedia CAL system was designed using *Director* (a *MacroMind* piece of software), a package designed to produce multimedia presentations. *Director* is a very flexible tool: it handles full-colour pictures, animation and sound easily, and at the same time provides a built-in programming language, *Lingo*, which makes the flow of control in the software fairly straightforward. The CAL software makes use of sounds recorded with the microphone, and pictures captured from a video camera and a colour scanner.

A system developed in *Director* is called a *movie*. Consistent with the Hollywood metaphor, a movie consists of *frames* in a *score*, where members of the *cast* can be choreographed to move on the *stage* (the screen). The flow of the movie through the score can be controlled by *scripts* written in *Lingo*, and scripts can be set to respond to a key press. The main limitation in dealing with *Director* seemed to be the designer's imagination!

The software can be customised for particular subjects by substituting the graphics and sound with those familiar to the subject. For example, the voice and picture of a care-giver can guide the subject through the exercises if desired.

The programmer spent the best part of three months making the software. The process was difficult, as the scanning, videoing and sampling of sound was quite difficult .

Software Procedure

The exercises were in the form of modules. The modules were:

	Number of questions in each module
Coin Recognition	
• What coin is this?	(10)
One Coin Problems	
• Baseline module, a spoken item value with no feedback	(5)
• Spoken item value	(10)
• Spoken item value & price tag	(10)
• Price tag only	(10)
Simple Two Coin Problems*	
• Baseline module, a spoken item value with no feedback	(5)
• Spoken item value	(10)
• Spoken item value & price tag	(10)
• Price tag only	(10)
Complex Two Coin Problems*	
• Baseline module, a spoken item value with no feedback	(5)
• Spoken item value	(10)
• Spoken item value & price tag	(10)
• Price tag only	(10)

Multiple Coin Problems

- Baseline module, a spoken item value with no feedback (5)
- Spoken item value (10)
- Spoken item value & price tag (10)
- Price tag only (10)

* Simple two coin problems = eg. $1.20 , 25¢
Complex two coin problems = eg. 60¢, $3.00

The baselines required subjects to answer five problems. They repeated the baseline until it was obvious that their score had stabilised. This was decided by the researcher. The other modules progressed automatically when the subject got full marks (10 out of 10). Subjects were not given ten questions for each baseline, as the researcher felt that this may produce boredom and frustration for the subjects, due to having no feedback or reinforcement.

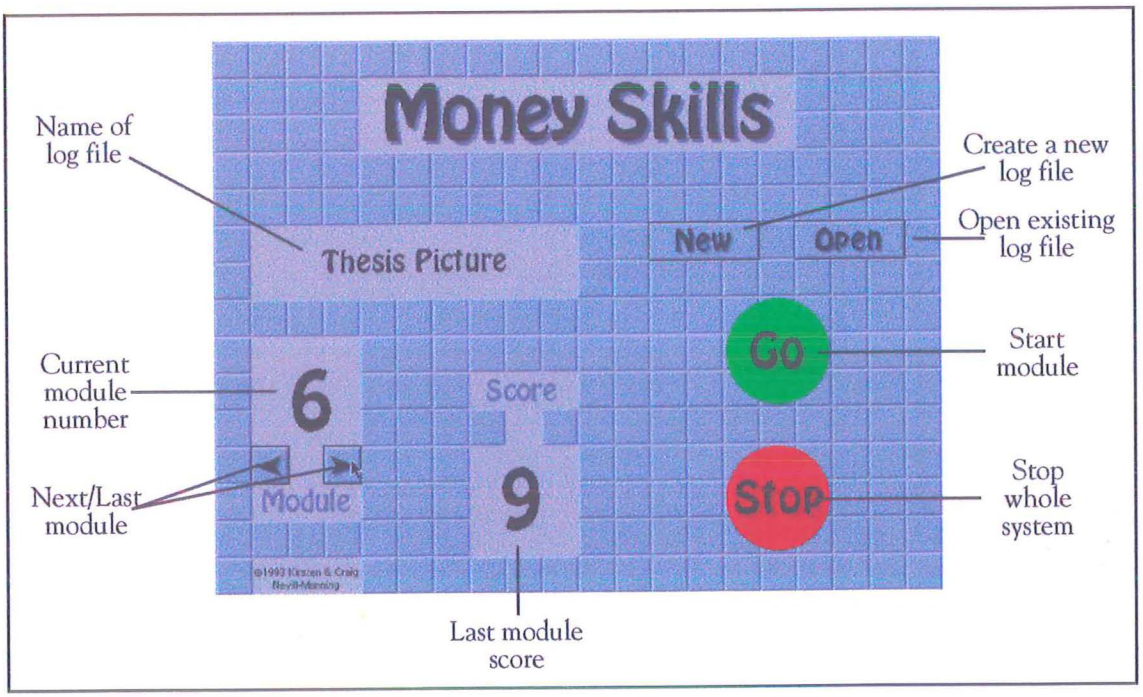
There were four sections: one coin, simple two coin, complex two coin and three coin problems, each divided into questions with verbal prompts, verbal prompts and price tags and then a price tag only questions. All cues and feedback was based on the ABC's mentioned earlier in *section 2.3.1.6*. If the subject received ten out of ten in a module, they progressed to the next one. If the researcher/administrator wanted a subject to repeat a module for some reason they could do so by pressing the left arrow under the module number. If the subject answered a question incorrectly, it would be repeated up to three times. If a subject got it incorrect on their third attempt, the CAL would progress to the next problem.

After completing all four modules in the one coin problem set, subjects progressed to simple two coin problems and so forth.

The Welcome Screen.

The welcome screen (*Figure 2-6*) is accompanied by a song by ABBA, called "Money, money, money". Each of the buttons on the screen were accessed using the mouse. The administrator typed in subjects names/alias and opened the system. Early in the program the administrator would press the 'go' and 'stop' buttons, later subjects did this themselves.

Figure 2-6 Welcome Screen



What the Prelude screens looked like.

Examples of one of the McDonalds and one dairy module screen are shown in *Figure 2-7*. As these appeared on the screen, music also played. These were included in order to make the interaction more realistic for the subject. These appeared as each module started, to give the illusion of entering a store.

What the Purchasing Screens Looked Like.

Once in the 'store', the first problem would appear on the screen. An example of how problems were displayed is shown in *Figure 2-8*. *Figure 2-9* shows a flow diagram of how problems were presented in each module.

Figure 2-7 Prelude Screens

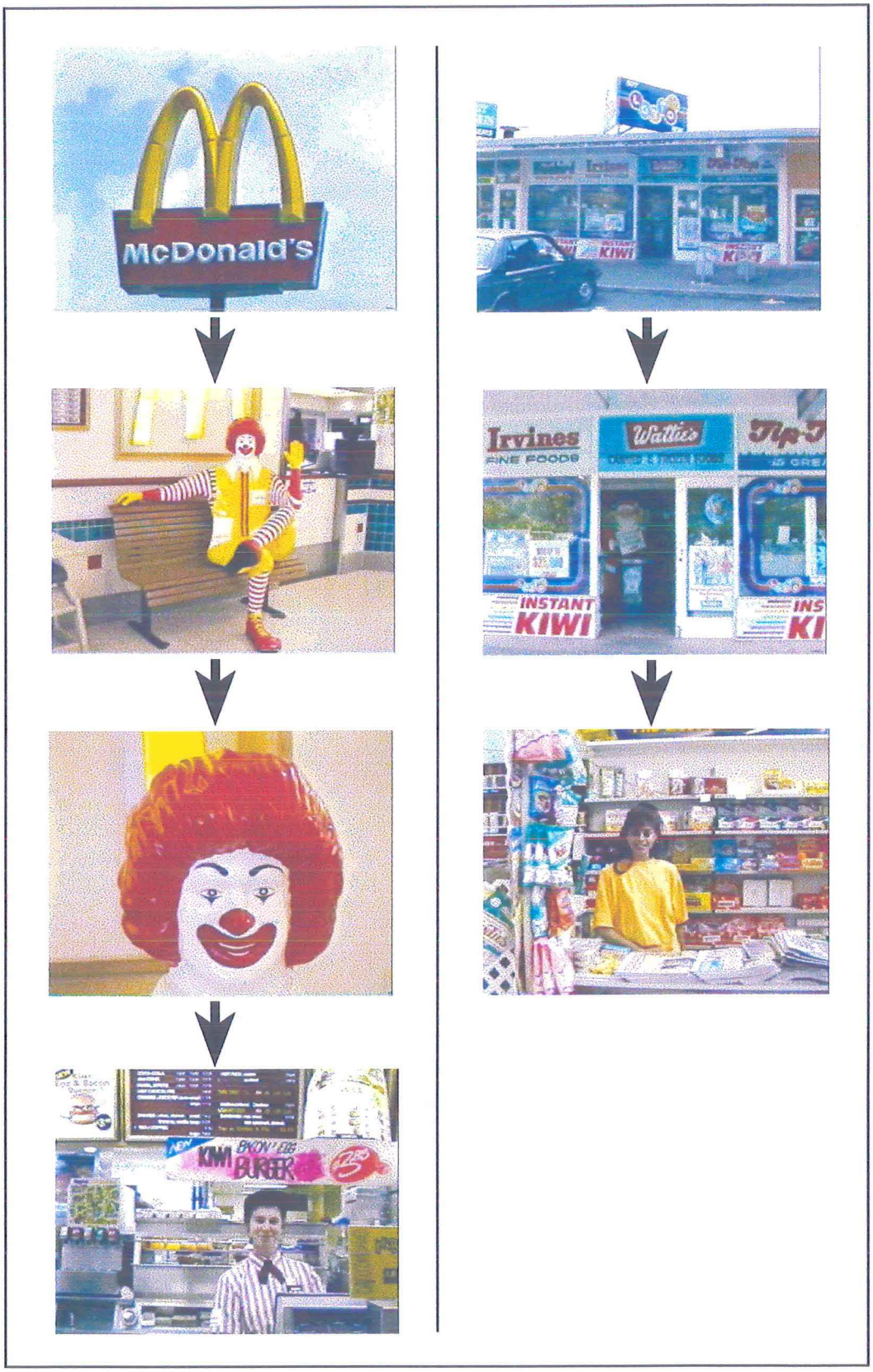


Figure 2-8 Purchasing screen

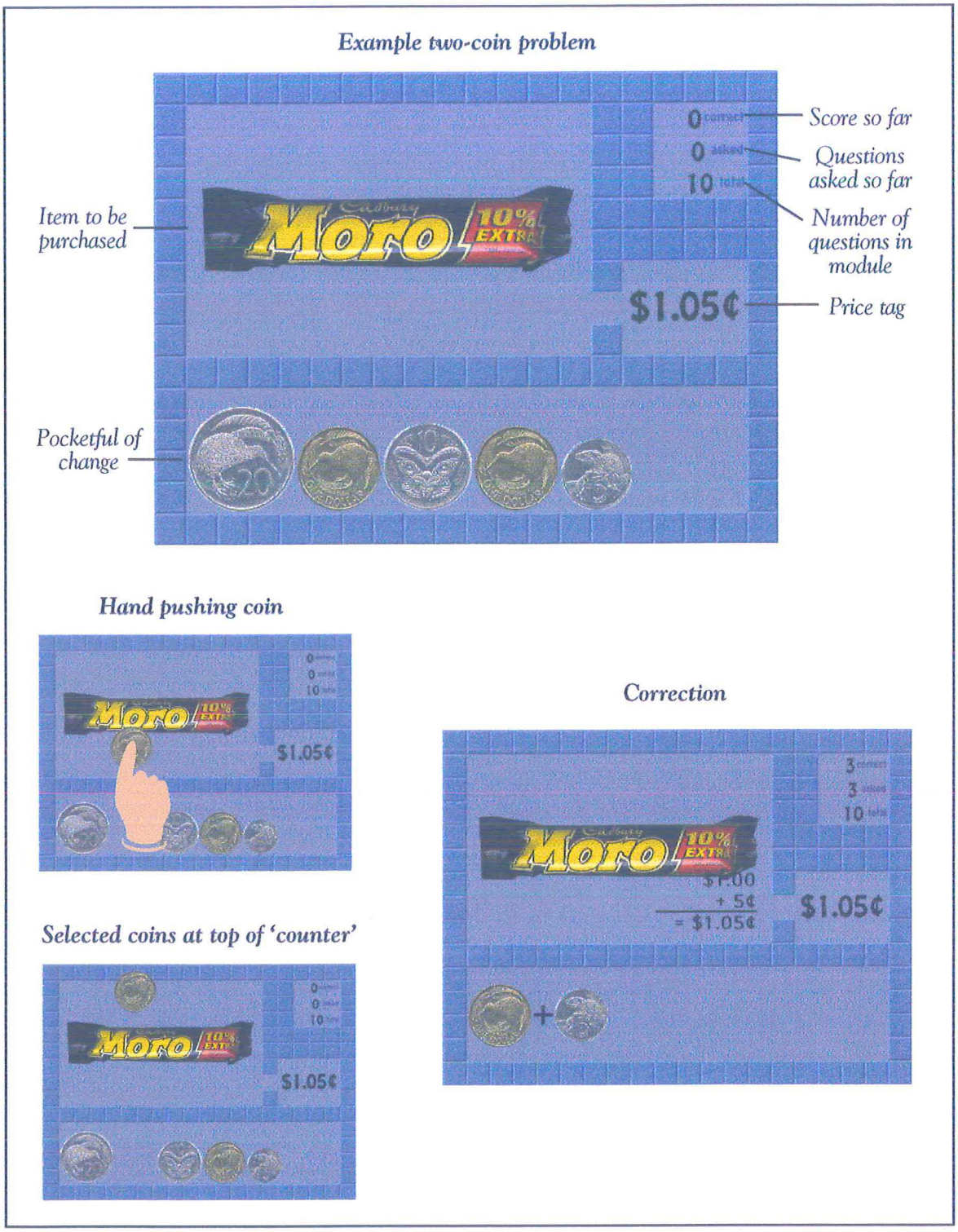
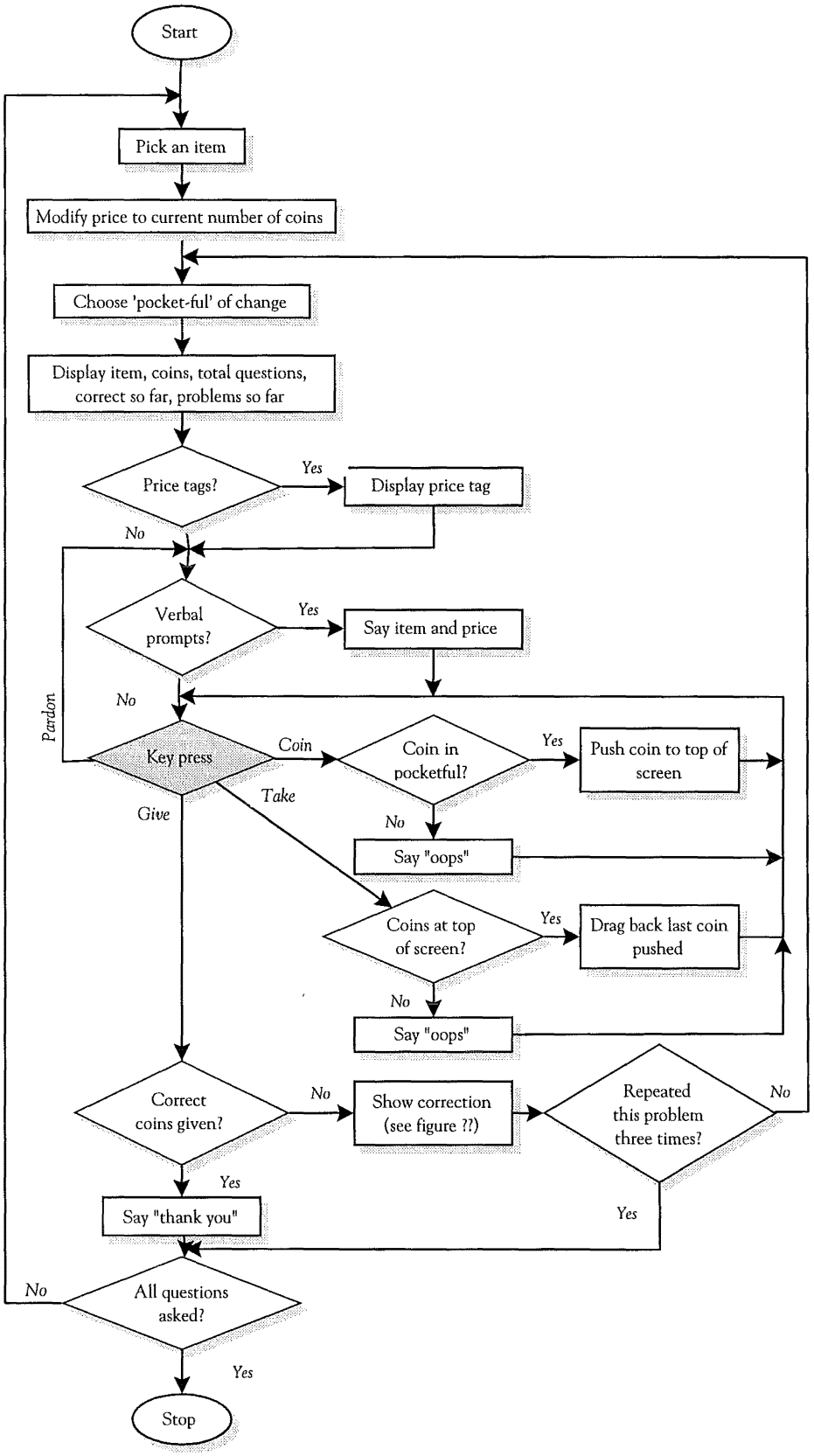


Figure 2-9 Flow chart describing the software procedure



If subjects had chosen coins correctly a voice saying "*Thank you*", "*Have a good day*" or "*That's right*" would sound and the next problem would soon appear on the screen. This sort of response was chosen, as it is close to what a store keeper would tend to say to a customer after they had finished their transaction.

On the other hand if subject were incorrect, accompanying the example of the coin(s) that should have been given, a sum, and a voice explaining why it was wrong would all appear. The voice would normally say "*sorry that was wrong. You gave me* ***the amount given*** *and I wanted* ***price of the item****, like this...*". Then all of the other things would appear on the screen. Once the subject had time to look at what the correct response should have been a voice said "*Lets try that again. Press the green key (in fact any key would do the same thing) to try that one again*". After the subject pressed the green key, the problem would appear again, at the same price, but with a different selection of coins. The procedure then followed as usual. After three attempts at the same problem without getting it right, another problem, with a different item would be presented.

After a module was completed and if the subject did not get one hundred percent the screen would return to its original look, with the ABBA song playing until the subject or the administrator pressed the "go" button. Subjects were given the option to draw in between, get a drink, chat, walk around, or whatever they chose to do. No pressure was applied to keep going, or to stop. The administrator tried to remain neutral.

Reinforcement after ten correct questions.
If subjects got ten out of ten the grid, coins, items, scores, and price tag would fade from the screen. In its place a space theme would appear on the screen with both music, written words and voice. For example, a woman saying "*Wow! You did amazingly well in that module!!!*" (refer to *Figure 2-10*) could appear, or a space ship may cruise about the screen with "*Well Done*" (refer to *Figure 2-10*) written on its side and loud music would play.

Figure 2-10 Feedback Screens

Subjects knew that if this sort of scene appeared that they also were able to choose from a range of stickers (eg., flowers, dogs, stars, love hearts, motor bikes cartoon characters etc.) to choose one and put it on a chart on the wall in the space with the number of the module they just completed above the box. They also received some money from the administrator to put in a money box, which they had chosen and put their name on. Each subject chose their own colour for their wall chart and money box name tag. Once again, subjects were given the option to draw, get a drink, chat, walk around, let another person have a go on the CAL, or whatever they chose to do. No pressure was applied to keep going, or to stop. The administrator tried to remain neutral.

2.3.1.7 Data Collection and Analysis

The baseline data provided a bench-mark of pre-intervention achievement for each subject, enabling objective assessments to be made about whether the subjects improved during and after intervention.

The CAL system logged all of the interactions that took place. This was a comprehensive log which recorded: subject name, date, time started, reaction times, question, item price, coins available, buttons pressed and the order pressed, repeated questions, the number of in/correct answers and time of completion. See APPENDIX H for an example log. These logs provided an objective recording of interactions between the CAL system and the subjects.

Apart from the quantitative data collected using logs, the researcher recorded qualitative changes in behaviour and comments made by the subjects when using the CAL. These qualitative aspects of behaviour were based upon observations and anecdotal recordings completed by the researcher both during sessions and when collecting subjects.

2.3.2 Observations in Actual Purchasing Situations (Probes)
(APPENDIX F)

There were five probes during the course of the intervention, one before the beginning of each new section in the CAL (e.g., before complex two-coin problems), and a final one at the end. Each took place in the same manner as the pre-intervention observations did—individually, with four separate items to purchase, in different stores each time (See APPENDIX G for the actual prices, items and pocketfuls of coins used)

2.3.2.1 Inter-rater Reliability

Two independent observers watched the video of subjects purchasing items in the stores. The timings from the video were the same for each observer, as the time was recorded objectively from the video. The difference in the marks out of ten given by each of the two observers were averaged over all the probes.

2.3.3 Activity Preference Test
(APPENDIX D)

This was done in the same manner as outlined earlier in the method section. The only change was that this questionnaire was given in the CAL lab, not in the subject's home. This questionnaire was presented to each subject when they were half way through the CAL program.

2.3.4 *Letter to Primary Care-givers about Subject Progress*
(APPENDIX K)

Purpose of Primary Care-givers	To inform care-givers about the subjects progress through the CAL teaching.
Format	Standard business letter
Materials	Example Letter (APPENDIX K) Administrator (to write and post the letter) Pen/pencil 1 envelope, addressed and stamped (if posting)
Procedure	Posted to the care-givers by the researcher
Preparation Time:	Five minutes
Administrator:	One
Subject::	One
Learning Context (Section 1.5.1	Home-teaching partnership Systematic program evaluation

The letter to primary care-givers (APPENDIX K) was a way of formally letting them know how the subject was progressing in the research.

The letter contained information about how well the subject was learning and whether or not they could transfer this to actual purchasing situations. There was also an offer extended to the care-givers that if they wished to discuss the findings so far they were welcome to contact the researcher.

2.4 Post-intervention Assessment

2.4.1 Activity Preference Test
(APPENDIX D)

2.4.2 Money Skills Test
(APPENDIX E)

2.4.3 Observation in the 'Real' World
(APPENDIX F)

Each of these tests was applied in the same settings, and using the same materials outlined earlier in the method section.

2.4.4 Social Validation & Acceptability Questionnaire for Primary Care-givers
(APPENDIX M)

Origin	Tiong,. (1989)
Modification(s)	Used a seven point scales, not a four point scale. Room for comments was provided after each question, not just at the end Included three questions which needed a yes or no response, plus a question which simply needed a written answer.
Purpose	To determine the difference(s), if any, care-givers noticed in subjects money handling skills Ascertain what they thought of the running of the program
Format	Seven point scales used 'Yes' and 'No' questions Room for comment provided after each question
Setting	Chosen by the person answering the questionnaire
Materials	Questionnaire (APPENDIX M) Pen/pencil
Procedure	Presented to each care-giver Filled-out in their own time Asked to be as honest as possible
Preparation Time:	Two minutes
Administrator:	One
Time to Complete:	Ten-fifteen minutes
Questions	Ten
Recording & Grading system	Seven point scale (five questions) 'Yes' or 'No' answers (three questions) Written response (two questions) All had room available for people to expand on their answers
Learning Context (Section 1.5.1)	Home-teaching partnership Community based training Curricular expectations Social integration Systematic program evaluation`

The researcher contacted each primary care-giver and asked them whether they would be willing to complete a questionnaire about the involvement of the person with IH they knew in the CAL money skills research. Each care-giver who agreed to fill out the form was sent a copy.

At the top of the questionnaire were some instructions. They asked the people who were completing the forms to:

> *"Please fill in this form honestly and alone. Do not talk to others while filling this out; it is your own personal opinions that count. This will help me to improve, where necessary, the course for the future. Remember, all of your information is given anonymously.*
>
> *Most of the questions require that you fill answer on a scale of 1 to 7. Opportunity is also given for you to expand and clarify your position if you wish".*

This questionnaire provided care-givers with the opportunity to have a say about the program. The objective was to find out what they thought of the CAL training for teaching the subject they knew money skills. It was hoped that the questionnaire would provide some insight into the ways in which the program could be improved in the future. Also it was hoped that some of the program strengths may be identified.

Care-givers were encourage to be honest with their answers. Just before the questions began was a quote stating;

> *"The greatest kindness I have to offer you is the truth"*
>
> *(John Powell)*

All responses were recorded, and there was no right or wrong answer, each was counted, each considered important.

2.4.5 *Social Validation & Acceptability Questionnaire for Subjects*

(APPENDIX N)

Origin	Tiong. (1989)
Modifications to the Subject Questionnaire	There were three additional questions needing either a 'yes' or a 'no' response. Like the staff questions each question had space underneath for expansion, if the subject wanted to elaborate
Purpose	To provide feedback about what subjects thought of the CAL money skills training
Format	Four point scales used 'Yes' and 'No' questions Room for comment provided after each question
Setting	At the participants home (this varied from a home to a flat situation), in their dinning room or bedroom. Only person present apart from the subject was the questionnaire administrator The lighting and ventilation was always good.
Materials	Administrator Questionnaire (APPENDIX N) Pen/pencil Tape recorder (optional) Video recorder (optional)
Procedure	Presented by an independent person Presented orally Questions were asked and then subjects were given time to answer. All questions and answers were recorded
Preparation Time:	Five minutes
Administrator:	One
Subject(s):	One (more if wished)
Time to Complete:	Five-fifteen minutes
Questions	Nine questions
Recording & Grading system	Four point scale (five questions) 'Yes' or 'No' response (three questions) Oral response (one question) All had room available for people to expand on their answers.
Learning Context (Section 1.5.1)	Age appropriate placement Systematic program evaluation

This is an oral questionnaire. It was give to subjects to find out what they thought of the CAL. It was presented to subjects by a person who was unfamiliar to them, to help eliminate any biased answers (either positive or negative) about the CAL program and their involvement with it. It should not be and was not, administered by the researcher.

When giving this it was made sure that subjects were comfortable, in a well lit and ventilated room and at ease. Like the primary care-givers questionnaire, subjects were told that it was their honest opinions that counted. Subjects were also told;

> *"The people that ran this programme are interested to see what you thought of it. They plan to use the information you give to change any future courses like this one.*
>
> *Please try to answer all of the questions I ask you. Your name is not going to be on the answers you give, so please answer them honestly. There is no right or wrong answer!"*

All options for questions were presented and then the subject had to choose one. The response was then circled by the questionnaire administrator on their questionnaire record sheet. The interaction was taped in order to get an accurate response from each subject, this was then transcribed and presented in full.

2.4.6 *Thankyou Letter to Subjects & Primary Care-givers*
(APPENDIX L)

Purpose of letter to subjects	To thank subjects for their time, energy and overall participation in the study/CAL To conclude the study To present primary care-givers with a written account of how the person with IH did in the CAL
Purpose of letter to Primary Care-givers	To thank primary care-givers, for allowing the person with IH to be involved with the research.
Format	Standard business letter
Materials	Letters (APPENDIX L) Administrator (to write and post the letter) Pen/pencil 1 envelope, addressed and stamped (if posting)
Procedure	Posted to the subject by the researcher
Preparation Time:	Five minutes
Administrator:	One
Subject::	One
Learning Context (Section 1.5.1)	Home-teaching partnership Systematic program evaluation

The thank-you letter to subjects and primary care-givers (APPENDIX L) was a way of thanking them for their involvement and to let them each know how subjects and the study went.

The letter contained information about how the subject concerned did learning from the CAL and whether or not they could transfer this to actual purchasing situations. The letter also contained the researchers gratitude for the time and energy each party had put into the research. There was also an offer extended to both subjects and care-givers that if they wished to discuss the findings further they were more than welcome to contact the researcher.

Results

The purpose of this chapter is to present the results of this study.

Outline

The results are given in the same order as in the method section:

Subject Selection:

- Needs Assessment Questionnaire Results (APPENDIX B2)
- Compilation of Subject Details Results (APPENDIX C2)
- Activity Preference Questionnaire Results
- Money Skills Test
- Description of the chosen subjects

Pre-Intervention:

- Observation in 'Actual' Purchasing Situations
- Computer Aptitude Test
- Letter about Subject Involvement & Ethics Form

Intervention:

- Inter-rater reliability
- Subject A
- Subject F
- Subject I
- Subject M
- Subject P
- Summary
- Activity Preference Questionnaire (half way through CAL)

Post-Intervention:

- Activity Preference Questionnaire
- Money Skills Test
- Social Validation/Acceptability Questionnaire—S (APPENDIX N2)
- Social Validation/Acceptability Questionnaire—C (APPENDIX M2)

3.1 Subject Selection

Throughout this section the results of subjects who were ultimately selected for the CAL are marked by a black border.

3.1.1 Needs Assessment Questionnaire

Table 3-1 summarises the yes/no or rating responses from the questionnaire and is followed by a summary of the comments made on the questionnaire. The original questionnaire is located in APPENDIX B and the full results are in APPENDIX B2.

Key:
✔ = yes ✗ = no
The scale was from ❶ = None ❼ = A lot

Subjects / Question #	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	✗	✗	✔	✔	✔	✗	✗	✗	✔	✔	✗	✔	✗	✗	✗	✔
2	❼	❺	❷	❸	❹	❹	❼	❸	❸		❻	❹	❼	❼	❺	❸
5	✔	✔	✔	✔	✔	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✔
6	✗	✗	✗	✗	✗	✔	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗

Table 3-1 Summary of the Needs Assessment Results

Question 1: ***Does the lack of money skills entail any danger?***

Nine of the sixteen care-givers thought that the lack of money skills did not entail any danger for the subject. In six of these nine responses the comment was made that they were not endangered because they had a person who knew money skills with them to help out (ie., they don't shop alone). Only G's care-giver stated that her reason for not being endangered was because she knew how to deal with small amounts of money. No elaboration on the response was given for subjects J and N.

Out of the 7 who stated that they were endangered only three commented on why they thought this. Subjects I, P and L's care-giver stated that they "could be ripped off".

Question 2: ***How many opportunities would they have to use this skill?***

Half of the responses indicated that the subject would use money regularly, giving ratings of ❺ and above. Primary care-givers for A, G, M, and N thought that they would use money a lot, giving the highest rating of ❼. The care givers who gave a rating of ❼ commented on the types of items their subjects often purchased, such as "G purchases her lunch regularly, as well as sweets, chippies etc.".

Subject C's primary care-giver gave a ❷, the lowest rating given by any care-giver. No elaboration was given for this care-giver's rating. Subjects D, H, I, and P were given a rating of ❸, three of the four care-givers cited the subjects reasons to use money for three activities each week. For example, subject P "buys the *Listener*, Lotto, and lunch once a week". The subjects who were given the middle rating of ❹ were E, F and L.

Question 3: ***How long-standing is the need for this skill?***

Most of the care-givers stated that the skill was needed throughout life, or since leaving school. One care-giver (for K, L and P) misunderstood the question and responded with the answer "As long as it takes". The care-giver for subject G stated that money skills were unnecessary. No elaboration was provided for this response.

Question 4: ***How will this behaviour aid other aspects of their life?***

Subjects A, B, D, G, H, I, M and N's primary care-givers stated that if the subject could handle money then they would gain more independence—be able to utilise the community more.

Subjects O, C, F and L's care indicated a hope or concern for having the subject realise the value of money and the expense of things they wanted.

Question 5: ***Does the lack of money skills draw negative attention from others?***

Nine of the sixteen subjects said that the lack of money skills does not receive negative attention. The primary comment to explain there response is that the subject "looks normal" and is quite "polite".

Question 6: ***Will having money skills be beneficial for significant others in the their life?***

All but one of the care givers indicated that this skill would be beneficial for significant others in the subject's life. The most frequent comment for this question was that this skill would mean that there was "less responsibility for staff and family".

3.1.2 *Compilation of Subject Details*

The full information is located in APPENDIX C2.

Subject	G	Age	Indep.	Physical disabilities	Ethnicity	Vocation	Supervision at home	Level of IH
A	F	29	Semi	limps	European	IHC	Full-time	Moderate
B	F	29	Semi	-	European	IHC	Full-time	Moderate
C	M	47	Semi	Epileptic	European	IHC	Full-time	Moderate
D	F	47	Very	-	European		Part-time	Mild
E	F	46	Very	Left side paralysis	European	IHC affiliated	Part-time	Mild
F	M	32	Very	Speech impediment	Fijian/ European	Trucking company	Part-time	Mild
G	F	29	Very	-	European	Supermarket	Part-time	Mild
H	F	38	Semi	Right side paralysis & epileptic	European	Creche	Part-time	Moderate
I	M	34	Very	Speech impediment	European	Factory Cleaner	Part-time	Moderate
J	M	39	Semi	Epileptic	European	Wooden toy factory	Full-time	Moderate
K	F	38	Semi	Epileptic & mood swings	European	IHC	Full-time	Moderate
L	F	20	Very	-	Maori & European	Kohanga Reo & IHC	Full-time	Mild
M	F	26	Semi	-	European	Sheltered workshop & Education Dept.	Full-time	Moderate
N	F	29	Reliant	20% vision in one eye 0% in the other	European	IHC	Full-time	Moderate
O	M	33	Reliant	Speech impediment	European	IHC	Full-time	Severe
P	M	29	Semi	Speech impediment	European	IHC	Full-time	Moderate

Table 3-2: Summary of Subject Details

The subjects interviewed in the pre-selection phase were all adults. The youngest (subject L) was 20 years old and the eldest (subject C) was 47. There was a reasonable gender mix, with ten women and six men. Fourteen of the subjects were of European descent. Subject F was half Fijian and half European and subject L was Maori.

Five of the subjects had no reported physical disabilities. C, H, J and K all were epileptics, however their epilepsy was mild and kept under control with medication. One of the people who had epilepsy was also partially paralysed down her right-hand side, with limited hand movement in this hand. Subject E had paralysis down her left hand side. Four subjects had a slight speech impediment, making oral communication difficult at times. Subject N was visually impaired, with 20% vision in one eye and almost zero in the other!

Six of the subjects (D, E, F, G, H and I) lived in flatting situations which were staffed for only a few hours each day or every other day. The rest of the subjects were in flatting situations which were staffed full-time.

Ten of the sixteen subjects were employed in IHC workshops. The other six people were employed in the community. The employment included working in a creche (subject H) and cleaning in a steel workshop (Subject I) and working for a trucking company (subject F). All of the subjects were able bodied, were employed and had few physical disabilities. The results from this questionnaire indicated that all of the subjects (except N, due to her eye-sight problem) could be included in the research.

3.1.3 *Activity Preference Test*

Table 3-3 shows each participant's activity preference scores for participating in a program to teach them money skills. Scores ranged from zero (no interest) to five (maximum interest)(refer to APPENDIX D). All of the activity preference tests were administered prior to, but on the same day as the money skills test.

Subject	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Money Skills (out of 5)	3	4	4	5	5	3	4	4	1	4	2	4	4	2	N/A	0
Time to complete test (min)	5	5	5	5	5	6	4	10	5	7	5	5	5	5	N/A	6

Table 3-3: Activity Preference Scores for Money Skills Activities by Subjects

Just over half (nine of the sixteen) of the subjects stated their preferences for learning money skills four or more times. A and F chose money skills three times. P never chose money skills even when the alternative option was cleaning the toilet! I, K and N all chose learning money skills less than three times. O did not state his preferences for any of the activities. Subjects tended to choose activities which required skills that they already had (eg., choosing to hang washing on the line and washing dishes).

The times to complete the Activity Preference Test show that all but two of the subjects were able to give their preferences for activities quite quickly—most chose their preference for each option within 30 seconds. H took the most time over these questions. H was reluctant to state which of the options suited her the best, she often stated that she liked neither, and had difficulty deciding on one over the other. H also needed numerous verbal prompts (eg. "Just pick *one* H" and "There is no right or wrong choice" etc.). One of the other factors, which may have influenced the amount of time that H spent deciding was that she was tested after three other people in her home, and by that stage it was 9.15 pm, and she had worked during the day and felt tired. Similarly, J also had difficulty deciding which option he liked the most, and spent seven minutes completing the questionnaire.

3.1.4 *Money Skills Test*

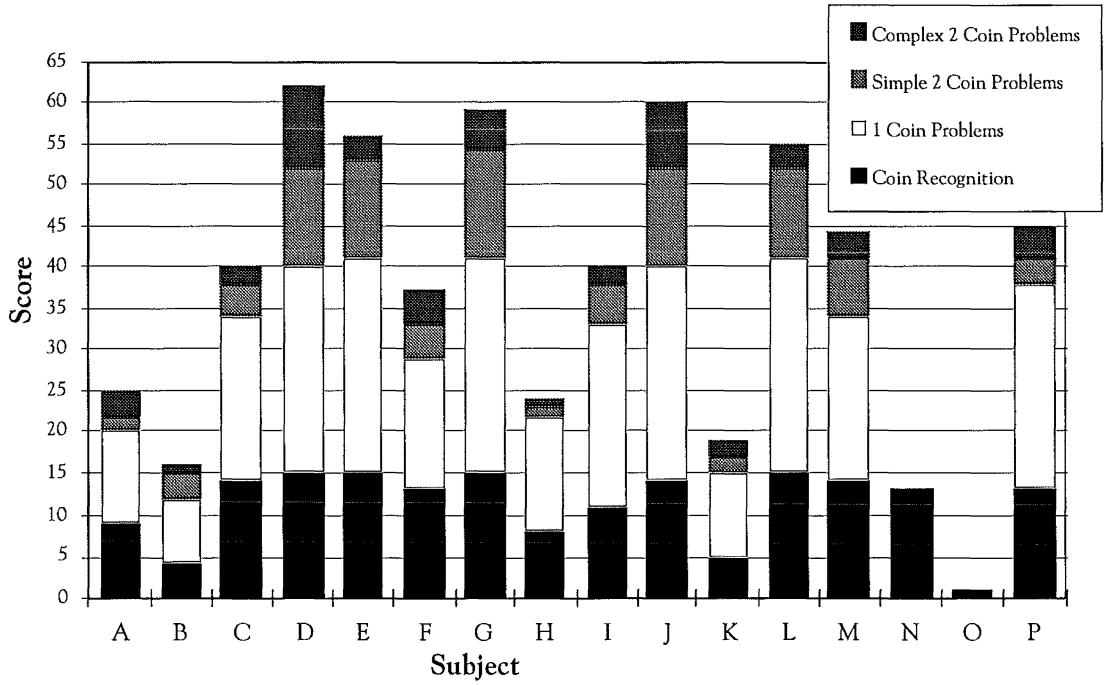


Figure 3-1: Money Skills Test Scores for each Subject across types of problems

The shading in the middle of the graph indicates the range from which subjects were chosen for the CAL program. It includes subjects who were able to score well on problems which involved recognising coins and on one coin problems, but were less competent on simple and complex two coin problems.

3.1.4.1. Highest Scores (55-62)

This graph shows that D, J, G, E and L's were already quite capable of using small amounts of money—all scored above 50 out of 65. D had the highest score, receiving 62. The others scored 60, 59, 56, and 55 respectively. Each of these subjects received almost perfect scores for both one and two coin problems. G, E and L made no mistakes in the first thirty-five questions, with D and J only getting one wrong. Most of the mistakes that were made by these subjects were on the complex two coin problems.

3.1.4.2. Middle Scores (25-45)

Subjects A, F, I, C, M, and P were able to recognise coins and name them. As a result of being able to recognise coins, each of these subjects were also able to do the one coin problems reasonably well, yet each had difficulty completing the two coin problems (both simple and complex). Their scores ranged from 25 to 45, respectively.

3.1.4.3. Lowest Scores (16-24)

Subjects H, K and B each scored less than 24. B scored the lowest score out of the subjects who completed the test, receiving a score of 16. Subject K scored 19 and subject H got 24 correct answers. They had difficulty answering questions that required one coin and even more problems completing two coin problems (especially complex two coin).

3.1.4.4. Did not complete the test

Subjects O and N did not complete the test. This was because O only had 20% vision in one of her eyes, and none in the other. The researcher was not informed of this prior to the beginning of testing. The researcher became aware of it when the subject got low marks (she was quite bright to speak with) and appeared to be straining to see the coins in the first problem set. When the researcher noticed this, she said to O that she was more than welcome to look more closely at the coins. O then picked up each coin in the row and put it up to her eye, and then was able to make her choice. O scored well on the first three problem sets, but the researcher chose to abandon this test as subject O was obviously becoming bored and uncomfortable—it took over half an hour to complete the first few problems.

Subject N simply refused to participate after the first few problems were presented. N made this known by picking up all of the coins, giving them all to the researcher and pulling down the front of his t-shirt and showing his chest!

3.1.5 Subject Selection Rationale

Not all of the subjects examined in this subject selection process proceeded to the next section. For instance, subjects D, E, G, J and L were very successful in the subject selection tests, and although their money skills needed to be extended (eg., to banking) they already possesed the skills that this research was hoping to teach. It was interesting however that each of these subjects said that they would like to learn money skills over other activities, choosing money skills 4 out of 5 times.

Subjects O and N were not included, as they did not have the ability (e.g., N's poor eye sight and O's uncooperativeness to communicate verbally with the researcher) to learn from the CAL system at this stage.

Subjects B, H, and K were not included, primarily due to their low performance on the money skills test. They each made many mistakes in the one-coin section, which was essentially coin recognition. They may however, have been well suited to a teaching program of money skills that was aimed at a lower level of performance than this CAL program was. This result, coupled with the fact that their primary care-givers did not rate their need to learn about or use money as great (eg., indicating that the skill would not benefit others, that the subject had no need for this skill and not having money skills did not entail any danger for the subjects) meant that they were not included in this program.

Subject C was originally to be included in the research as all of the results indicated that he needed and would benefit from learning money skills. The reasons he was not included was because he moved homes within the IHC and developed behavioural difficulties.

Each of these aforementioned subjects was sent an individualised card, thanking them for their participation.

Subjects A, F, I, M, and P progressed to the next phase of the subject selection. They were chosen for two main reasons: because their primary care-givers felt there was both a need and a use for the skill of basic money handling, and because they were able to recognise coins yet showed difficulty in two coin problems (both simple and complex). One concern to the researcher was their low scores in the Activity Preference Questionnaire. Their scores were 3, 3, 1, 4 and 0 respectively. They were kept in the program because the researcher was not sure whether or not their attitude might change when they began using CAL.

It was still not clear whether or not these subjects could use the money skills that they did have in the 'real' world, so they were observed in a natural setting to determine the extent of their need to learn more about money handling. They also needed to pass a computer aptitude test before they were able to begin the CAL. Any anomalies picked up in the pre-intervention assessment, would have meant that they were not included in the research.

3.2 Pre-Intervention Assessment

Despite the fact that subjects had been selected based on the tests and questionnaires in the last section, if problems occurred in the next two assessments that might impede learning using CAL, these subjects would not have been included.

3.2.1 Observation in 'Real' World

This was conducted in the same manner as the probe tests, across four coins and in a real purchasing situation in a store. All subjects scored zero in all four tasks, and as a result, all subjects could be included in the study and all of these preliminary observations were used as their first probe.

Several other questions were originally included in the evaluation but during the observations they were found to be irrelevant in this study (see APPENDIX F).

3.2.1.1. Reliability

The inter-rater reliability was calculated by taking the difference between the scores out of ten calculated by each observer for a particular problem, dividing it by the larger score given, subtracting this from 1 and converting to a percentage. For example, if one observer rated the response as a 6, and the other an 8, the inter-rater reliability would be:

$$\left(1 - \frac{8 - 6}{8}\right) \times 100\% = 75\%,$$

or for 10 and 9:

$$\left(1 - \frac{10 - 9}{10}\right) \times 100\% = 90\%,$$

These individual problem reliability percentages were averaged over all of the probes in question. In this case, the average inter-observer agreement over the 20 pre-intervention probes was 97.7%. This same formula was used to calculate the inter-rater reliability during intervention.

3.2.2 Computer Aptitude Test

The test was a simple coin recognition test where the computer asked verbally "What coin is this?" and required the subject to press the corresponding coin on the money keyboard. Subject A had scored 9 out of 10 twice, and then got 10 out of 10. The rest of the subjects scored 9 out of 10 once and then answered all of the questions correctly. Therefore, all of the subjects passed—each managing to make the connection between the money keyboard and the computer screen. Two prevalent comments about the CAL during this test was "this is magic!" and "where does the noise come from?".

3.3 Intervention

Each subject's graph is presented followed by a textual summary and a brief anecdotal description of the subject's experience.

3.3.1 Reliability

Reliability was calculated as described in section 3.2.1 to be 97.4%

Legend for Graphs

- □ Baseline
- ◇ Verbal Prompt only
- ◈ Verbal+Price Tag Prompt
- ◈ Price Tag Prompt only
- ◆ Probe

'P' signifies a probe in an actual purchasing situation

'B' signifies a baseline test, which are scaled to a score out of ten (they consisted of five problems to minimise the negative effects of the lack of feedback)

Attempts other than baselines are numbered.

The vertical gray line indicates the five week gap before maintenance probes. There was one week between the maintenance probes

3.3.2 *Subject A*

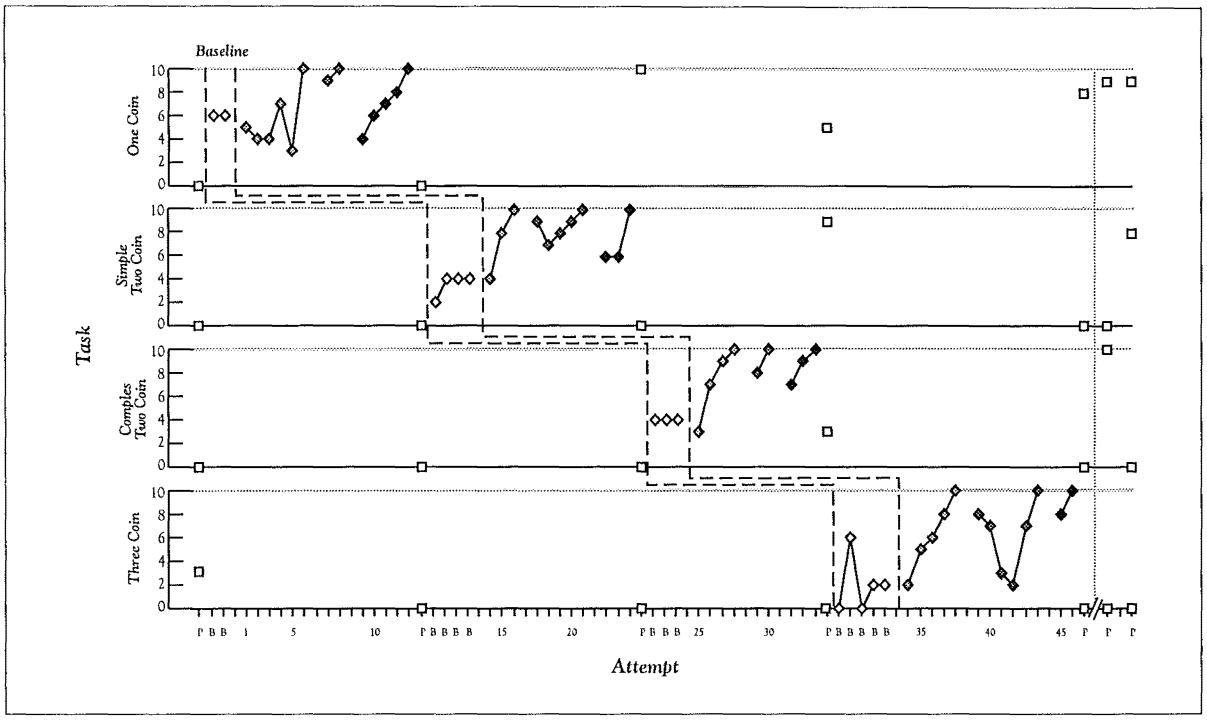


Figure 3-2 Subject A's Baseline, Intervention and Probe Results

Baselines Subject A's baselines reached stability rapidly for all tasks except the three coin problems, where she took five attempts to stabilise. Her stable baseline scores were 6, 4, 4 and 2 for the four tasks.

Intervention Subject A's first score on each task corresponded closely to her baseline scores (5, 4, 3, & 2 respectively). Subject A took more attempts to complete the one and three coin tasks (13 attempts in each) than she needed to complete the other two tasks. The average number of attempts that she took to reach criterion on a module was 3.8.

The price tag only prompt appeared simplest for Subject A, needing fewer attempts for this problem type. She was obviously able to transfer the skills learnt on the first two prompt conditions to the price tag only condition.

Probes (transfer) Subject A did not pass any of the probes prior to intervention taking place, scoring zero on all four. Subject A transferred and maintained one coin skills in all probes. In tasks 1 and 2, A performed badly on the probe directly following intervention, but well on the probe after this, with scores of 10 and 9 respectively.

The fifth probe was particularly poor for subject A; she scored zero on all tasks but the one coin problem, where she received 8 out of 10.

Maintenance Subject A never showed real competency in transferring the complex two coin task until the sixth probe, where she scored 10 out of 10. This is unusual, especially as in the next probe she scored 0 again. The scores in the maintenance probes were consistent with those during intervention, exhibiting the same erratic tendencies for all problems apart from one coin problems.

3.3.2.1. General

Initially subject A was quite excited about being picked to be involved in research at the University. She was however disappointed that her best friend and flatmate was not included (Subject B). The first six times that the researcher picked her up for money skills she asked if we would be picking up her friend.

Subject A often commented on the program. For example, "where does the voice come from?" and "this is magic" were two of the phrases she used initially. Sometimes her comments would be accompanied by looking behind and under the machine for a person or speakers.

Subject A chose to answer only ten to twenty questions per session. She chose to do more than ten questions either after a baseline phase (which was quick) or if she got 100%.

When the coins were switched around, turned upside down, or the new twenty cent coin was used, subject A would always comment. The first time the coins were turned upside down she said "these are upside down!" and looked to the researcher to remedy this. The only other effects were an initial reduction in reaction times.

During the price tag prompt condition subject A would almost always point to the screen price and then place her finger on the money keyboard, and search for the same numbers. The researcher would often here her say things like "that has a two and an

'o'". She appeared to find this simpler than trying to remember the price of an item without the written prompt.

Subject A found the program quite difficult, at times complaining about "the man inside the computer" and the way "he tells me off" and "he doesn't like me". When she got several problems incorrect, consequently she would say "oh, not again". The researcher recorded many comments like this from her during the simple and complex two coin problems. During the complex two coin section subject A's entire attitude seemed to change. She no longer got dejected or took the criticism personally; she seemed to understand that it was not telling her off when she made a mistake, merely guiding her. From this point on her attitude changed and she approached the CAL system with a great deal more vigour and enthusiasm.

Towards the end of the CAL intervention, she got very excited about the letter I would be sending her family and primary care-givers about her progress, getting her money box, pictures and chart! She talked about this almost constantly for the last task. She asked what sort of things I would write, how she did compared to others on the charts etc. She did not seem to concentrate as much, which may account for the dip in the second to last module.

The results of the maintenance probes may be attributed to the fact that once the CAL program was over, the primary care-giver started to ask subject A lot of questions about money and purchasing things. The primary care-giver did not want to see the skills that subject A had acquired go to waste. As a result, subject A was also going to her local dairy more regularly and using money instead of an account.

3.3.2.2. Notes from the Video of the Probes

It was noted in many probes that subject A was easily distracted while she was making a purchase. Initially, subject A would offer all the coins to the shopkeeper without trying to work out the correct coins.

During probes 3 and 4, Subject A said "It's hiding from me!"—referring to the money she had to purchase an item. The fifth probe was especially poor in the transfer of skills for subject A. During this probe, she appeared to be complacent and not to be putting in much effort. It was when watching the video and witnessing subject A's interaction with the shopkeeper that the researcher realised that her poor result may be because the probe was taking place at subject A's local dairy. Subject A often purchased things at this dairy, so knew the owner and, she usually placed things on an account, as opposed to using money.

Summary The results for Subject A show that she achieved criterion on all tasks using the CAL system, and transferred and maintained one coin skills. Transfer of the other skills was erratic, and she failed to transfer three coin skills. The baselines and probes prior to intervention show that subject A was originally unable to use money either on the computer or in the real world.

3.3.3 *Subject F*

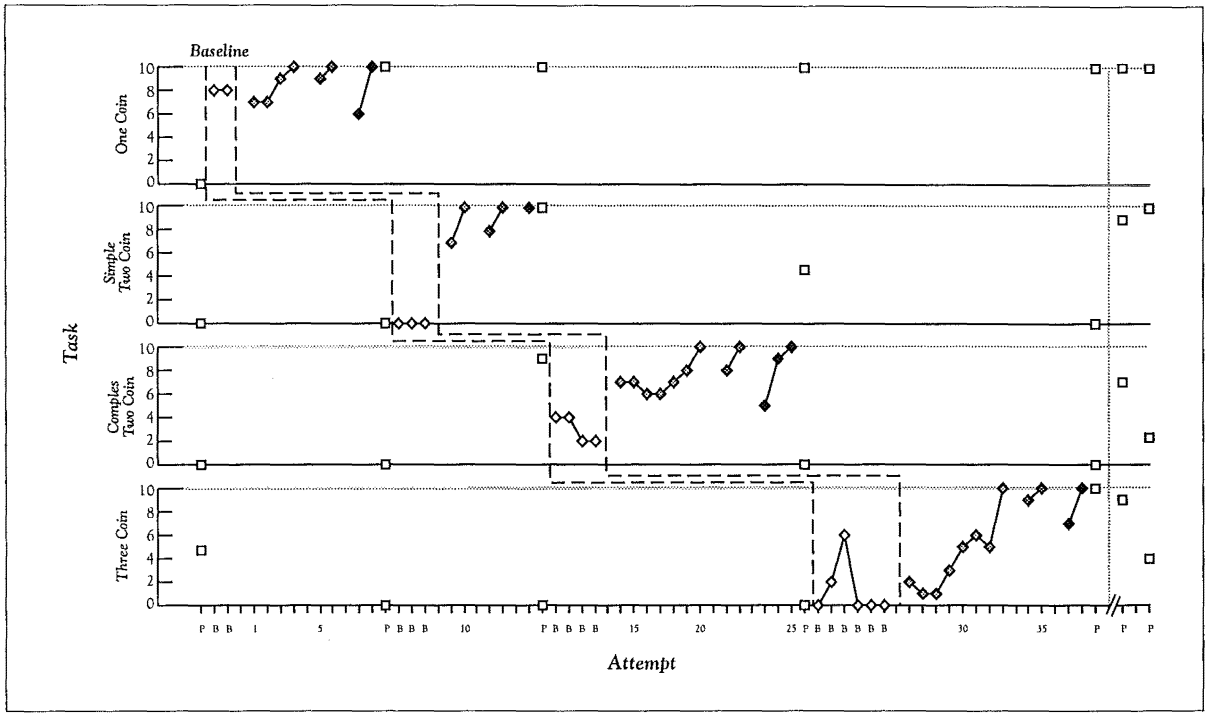


Figure 3-3 Subject F's Baseline, Intervention and Probe Results

Baselines Subject F's baselines reached stability quickly for all sections except the final section, where stability was reached only by the sixth attempt. His stable baseline scores were 8, 0, 2, 0 for the four tasks.

Intervention Subject F's first score on the first and fourth tasks corresponded closely to his baseline scores (7 & 2 respectively). He performed considerably better on his first intervention for simple and complex two coin problems (7 & 7 respectively) than his baseline scores.

Subject F found the three coin problems with verbal prompts quite difficult, having eight attempts at the questions before he reached criterion. Subject F needed more attempts at the last two sections ($\overline{x}$ =12 attempts) than on the first two ($\overline{x}$ =6.5 attempts) in order to get 10 out of 10. The average number of attempts that he took to reach criterion on a module was 3.1.

Probes (transfer)

Subject F did not score well before intervention on any problems apart from two coin complex (which appears to be chance occurrence), however he transferred all task skills (scoring 10) immediately after intervention (apart from complex two coin problems, where he scored 0).

Two coin scores were erratic, ranging from zero to ten in the probes following intervention.

Subject F performed well on the third probe. He maintained proficiency on one-coin problems throughout all probes. Subject F's fifth probe indicates that transfer of training was very poor, scoring zero on all problems except for one coin problems.

Maintenance

Surprisingly, subject F performed well on the maintenance probes, especially the sixth probe, where he did not score below 7. His scores had however dropped by the last probe for the complex two coin and three coin tasks.

3.3.3.1. General

Subject F was keen to be involved in the money skills course, especially since it was held at the University.

Subject F was intrigued with the CAL system, saying things like "this is like TV" and "the money skills song was on TV last night. They used your song" ("Money, money, money", by ABBA). Initially, he commented on the money keyboard, saying that he'd "never seen one like this before!", and asked "Can you type on it?". Subject F also kept referring to the Indian woman at one of the dairies as his IHC manager, as she was Indian and also owned a "dairy shop". Every time she appeared F would say "Hello Yashmin!" and wave. He also said that he had shopped at the East Street Superette. F also enjoyed commenting on items that appeared, like the beer. He would often say "I'll have that one, please" looking at the researcher and grinning.

Subject F enjoyed working on problems for a reasonable length of time. However, he always wanted a break to draw pictures. Many of the pictures that he drew were of the CAL system and the researcher (APPENDIX J). He would often include computer and put a face on it, or draw the speakers on top of the computer etc.

When the coins were switched around, turned upside down, or the new twenty-cent coin appeared, subject F would often not comment.

Subject F never appeared to get disgruntled when he made mistakes.

Throughout the CAL subject F would talk about the money he was getting in his jar, and how he was saving this for a trip to Fiji in January. He seemed excited each time he got 10 out of 10 and more money was put in his jar.

Summary

Subject F was unable to perform two and three coin tasks either in the probes or on the computer prior to intervention. Transfer occurred on one coin problems, and was maintained five and six weeks after intervention. Transfer was erratic on two coin problems. For three coin problems, it is difficult to ascertain whether subject F transferred this skill, as immediately after intervention he scored 10, but this tapered off to 4 by the final probe.

3.3.4 *Subject I*

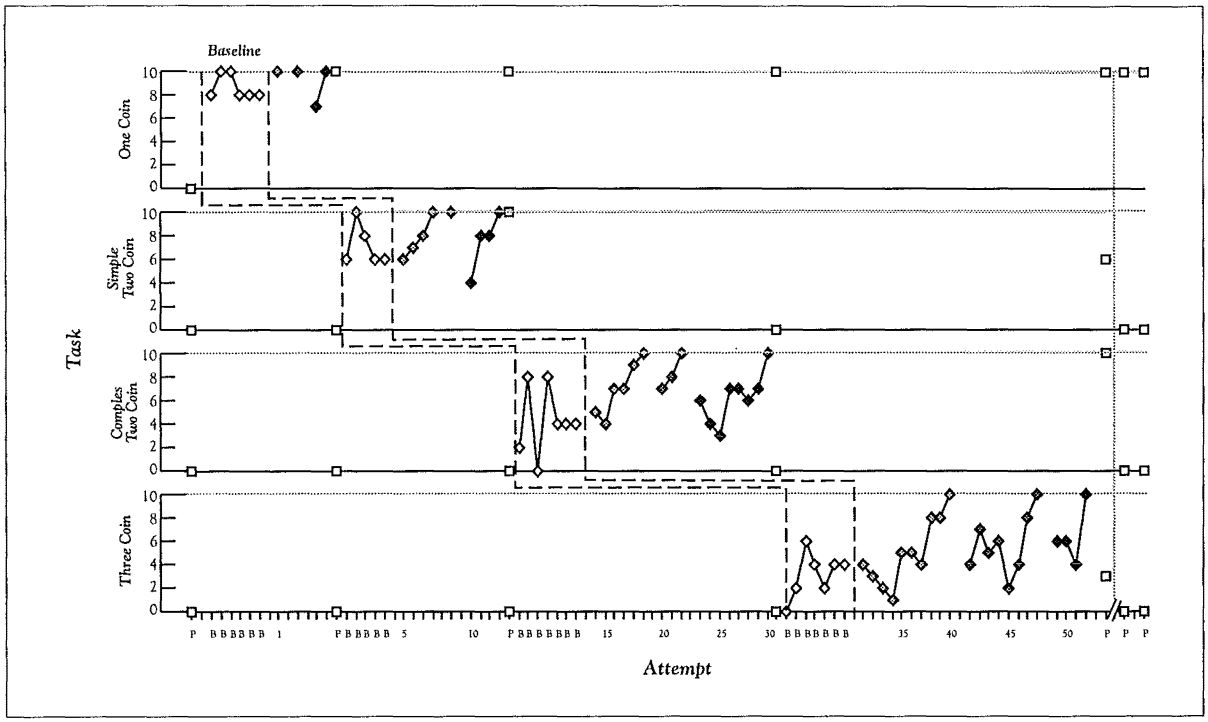


Figure 3-4 Subject I's Baseline, Intervention and Probe Results

Baselines For subject I, it was difficult to get stable baselines (scoring 8, 6, 4, & 4 across tasks), however the baselines did correspond with his initial intervention scores (10, 6, 5, & 4). The average number of attempts to reach a stable score across all baseline tasks was 5.5.

Intervention Subject I reached criterion (10 out of 10) across all four tasks with an average of 4.3 attempts per module. Subject I needed only four attempts to get 10 out of 10 for the one coin task. However on the last two tasks subject I took longer than all the other subjects (17 & 22 attempts respectively). Subject I continued to find the tasks difficult as the prompt condition changed. For example, he found the complex two coin task with no verbal prompt more difficult than the previous trials, even though he had had practice with complex two coin problems.

Probes (transfer) Subject I scored zero in all tasks prior to intervention, and showed some degree of transfer to all tasks apart from the complex two coin problems directly after intervention. He retained one-coin skills throughout the intervention, while two coin scores fluctuated. He performed best during the fifth probe, but poorly (0 out of 10 in all problems apart from one coin problems) in his fourth probe. Subject I had an almost binary distribution of scores on probes, either scoring zero or 10 in each task and probe.

Maintenance Subject I maintained his transfer of one coin tasks, scoring 10 in both maintenance probes, while his scores for all other tasks dropped to zero.

3.3.4.1. General

Subject I seemed pleased to be coming to money skills, as he was always ready when the researcher went to pick him up. However, he often appeared complacent when at the University. The researcher asked him if he enjoyed coming and he always said "yes". The researcher would always ask if he wished to terminate the session for that day, and he almost always said "no", wishing to try more problems. He would frequently say things like "I'd like that" and "How much?" when certain items appeared on the screen. One day he pulled the money out of his pocket and showed the researcher how much he had, and expressed a real interest in buying the cigarettes.

Subject I was shy around the department, not really conversing with anyone, even those who tried to speak with him. Subject I was however always keen to start a session off with a coffee and popcorn. These two things appeared to motivate him.

Subject I would often opt to come to sessions alone, rather then in the company of other people with IH . Subject I did not partake in the drawing either, preferring to sit and watch and eat popcorn if he wanted a break.

Subject I didn't seem to be excited when he got 10 out of 10 and the computer gave him a movie and congratulations messages. He did however seem intrigued with the aircraft and looked interested in what they were doing. Subject I only seemed to be happy about his achievement when the researcher congratulated him. The stickers did not appear to motivate him, but the money in the jar enthused him.

3.3.4.2. Notes from the Video of the Probes

Subject I gave all of the coins to the shopkeepers in most of the probes. He gave the appearance of complacency in the dairy. He relied on the shopkeepers, trusting them to perform the transaction on his behalf, exhibiting signs of 'learned helplessness'.

Summary

The results for Subject I show that he achieved criterion on all tasks using the CAL system, and transferred and maintained one coin skills. Transfer of the other skills was negligible. The baselines and probes prior to intervention show that subject A was originally unable to use money either on the computer or in the real world, with the exception of one-coin tasks which he could perform on the computer.

3.3.5 *Subject M*

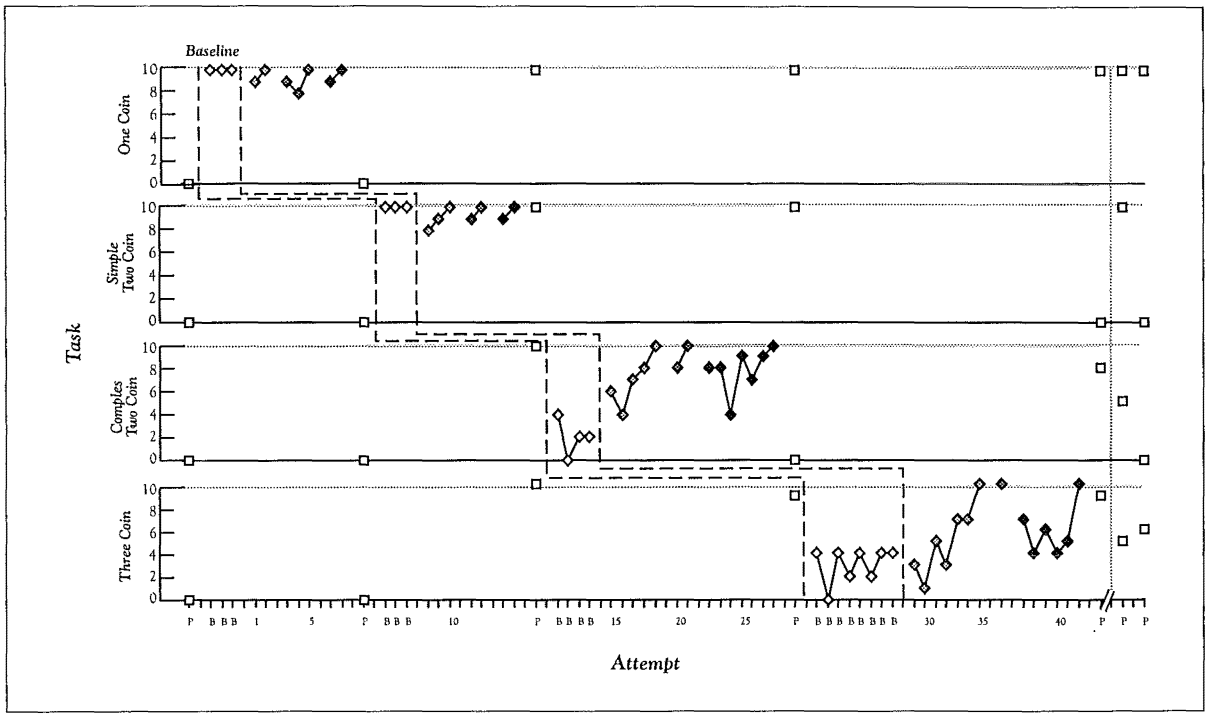


Figure 3-5 Subject M's Baseline, Intervention and Probe Results

Baselines

Subject M's baselines reached stability quickly except for the three coin problems, where stability was reached only on the eighth attempt. Her baseline scores across the four tasks were 10, 10, 2 and 4 respectively. The average attempts she needed to reach criterion across all four tasks was 3.5 attempts.

Intervention

Subject M's results for both one coin and simple two coin problems, indicate that she was already capable (x=7.5 attempts). She had more difficulty with the last two tasks, with 14 attempts at each of these sections. In the last two tasks subject M found the verbal condition difficult, the verbal and price tag relatively simple, but then had difficulty when the verbal prompt was removed. This was reflected in her scores, receiving 5, 2, and 7 (respectively) for the third task and 7, 1, and 6 (respectively) in the fourth task.

Probes (transfer) Subject M scored 10 out of 10 on all problems in the third probe, even on problems that she had not been taught, while she scored 0 on all tasks in probes one and two. She maintained one coin problem transfer throughout the CAL, while simple two coin problem transfer dropped off by the fifth probe. The results of the fifth probe show that subject M achieved a high level of transfer on all but the simple two coin problem.

Maintenance Subject M maintained one coin skills throughout the probes, while complex two coin and three coin tasks yielded lower transfer scores five and six weeks after intervention. Simple two coin scores went from 10 to 0 in the six and seventh probes.

3.3.5.1. General

M came to money skills twice a week, most weeks.

Subject M seemed pleased to be coming to money skills. She would always be ready at work for the researcher to pick her up. On the occasions that family commitments meant that a session was cancelled, M always expressed disappointment.

Subject M had numerous comments about the CAL throughout the program. When she first saw the man at a dairy, she said "Oh, a man" and giggled. When he appeared the next time she said, "Not him again". During other shots subject M commented on the bags of lollies, the shop assistants etc. Sometimes when food items were purchased M would say things like "oh, yum a Moro bar!". Subject M also would comment on the dairies themselves saying things like : "Maggie brought me here. We parked behind there" and pointed to the appropriate place at the same time. Subject M commented on the money keyboard, saying "Oooh, this is different!".

After a while M would say things like "Not this one again" and "back to this dairy?" and sigh, she appeared a bit disappointed, as she noticed the repetition of items and dairies. This reaction may account for the difficulty she experienced in the last two tasks during intervention, following the successful probes. However, subject M, never said that she didn't wish to come to money skills again.

M enjoyed working for long periods of time, without breaks. She was a determined young woman and disliked getting problems incorrect. When she did, she approached them with even more vigour and determination! Some days M would work for anywhere from $1\frac{1}{2}$ to 2 hours on the CAL. It was usually the researcher that called the sessions to an end as it was nearing subject M's dinner time.

M also enjoyed going to the CAL without the other subjects. The researcher asked her several times if she wished to go with the others as she almost always declined.

Subject M never liked to draw when waiting to use the CAL, preferring to sit and talk with the other subjects or the researcher. M also enjoyed walking around the department and meeting people. She looked forward to this sort if interaction and friendships started to form between some of the people. She enjoyed both the stickers and the money she received for achieving criterion during intervention.

3.3.5.2. Notes from the Video of the Probes

M's behaviour changed in regard to how she gave the appropriate coins to the retailer. At the beginning of probes she just gave the coins out of her hand, by the end she was placing them on the counter (in no particular pattern) and then choosing which coin to give. Subject M's confidence appeared to increase, as each probe took place, and by the third probe she was very confident. This confidence could explain the excellent probes scores that subject M received. Perhaps subject M already knew the money skills for the one and simple two coin problems, but had never had the opportunity to use these and the CAL system and probe tests gave her confidence in her own abilities. Subject M was inquisitive during most probes, always looking at customers and items. Socially, she interacted well with shopkeepers.

Summary

The results for Subject M show that she achieved criterion on all tasks using the CAL system, and transferred and maintained one coin skills. Subject M seemed to have flashes of inspiration, when she would perform tasks easily, even before she had been taught them. At other times she appeared to have difficulty. Overall, subject M transferred the most successfully of all the subjects.

3.3.6 *Subject P*

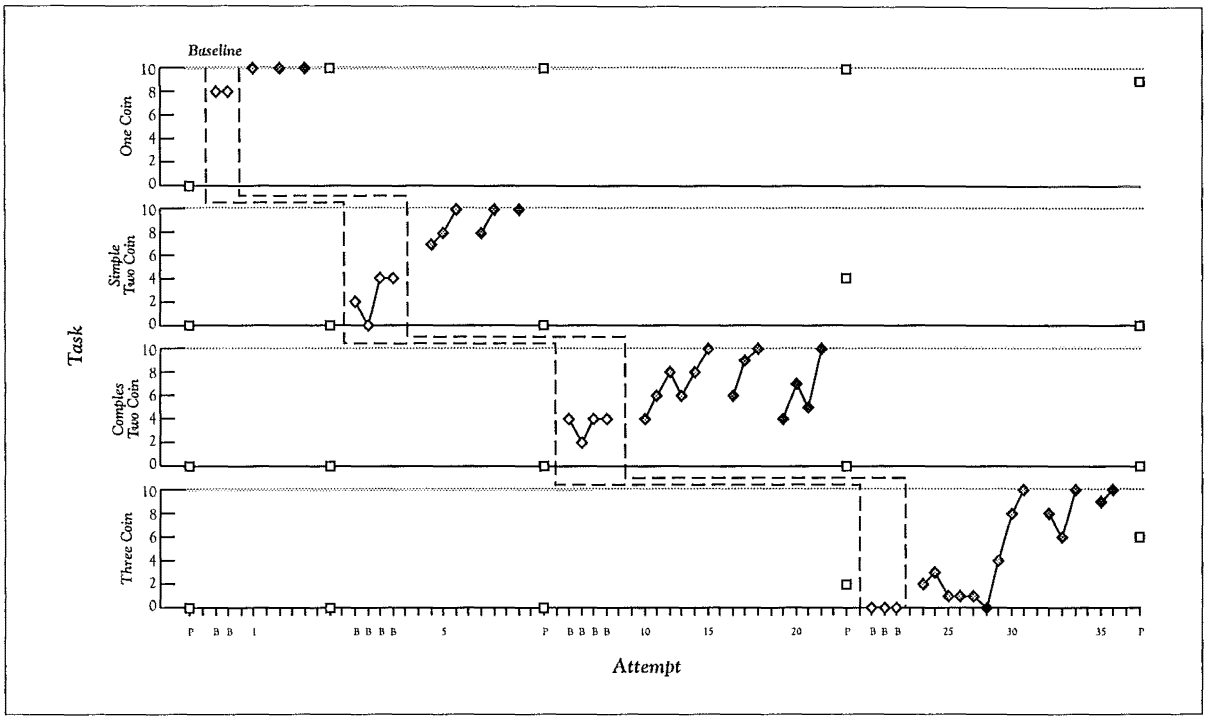


Figure 3-6 Subjects M Baseline, CAL and Probe Results

Baselines Subject P's baselines reached stability rapidly for all tasks. His stable baseline scores were 8, 4, 4, and 0 respectively.

Intervention Subject P reached criterion immediately for one coin problems, and relatively easily for two coin problems. Results indicate that he found three coin problems more difficult. The average number of attempts that he took to reach criterion on a module was 3, the least number of attempts of any subject.

Probes (transfer) Subject P could not perform any of the tasks before intervention. Probes performed after intervention indicate that he transferred one coin problems relatively easily, but did not demonstrate transfer for any of the other tasks.

Maintenance Due to subject P being ill over the time of maintenance probes, no results were able to be obtained.

3.3.6.1. *General*

P came to the University two times a week. However he did have two breaks during the program, when he went away with is family for a holiday. P was always keen to come to money skills and would often run from the car to the building where the CAL was. He thought that it was exciting being at the University and working on a computer. Both of these tasks he had never done previously. Outside of the CAL program if the researcher saw P he would ask questions like "How is the computer—alright?".

The first time subject P came to the University, it took approximately 45 minutes to get P upstairs to where the computer was, as he was terrified of heights (the researcher was not aware of this prior to commencing the CAL program). Once in the room, P seemed to be fascinated by the computer. When he saw the first prelude screen shot of going into a dairy he said "Superman is coming, Superman is coming!!" and appeared most animated and excited about this. When the Indian man standing behind a counter at a dairy appeared, he looked most dismayed.

When P got problems wrong it was common to hear him say "oh dear" and "oh, no". In contrast, when he got a question right on a retry he would often say "Gotcha" and put his thumb up! He received great pleasure from beating the machine. At times the researcher also noted him saying things like "I'll get you" and "I got it!".

Subject P watched the scores on the screen closely, monitoring his own performance. Each time the reinforcement for getting 10 out of 10 appeared, subject P grinned from ear to ear. He enjoyed the different noises, music and animation that appeared. Subject P also enjoyed getting stickers, although he did not like a lot of the selection, saying "oh, how cute" about some of them. Near the end of intervention, subject P commented on the fact that he had seen many of the items previously. However, this did not seem to bother him, appearing quite pleased with himself for having noticed.

P also enjoyed talking with the researcher about TV programs such as "Thunderbirds". The CAL was sometimes compared with Thunderbirds, especially the space craft and music.

3.3.6.2. *Notes from the Video of the Probes*

During the first probe, subject P was reluctant to go into the dairy. His behaviour changed a great deal from the first video to the post intervention observation. When he first purchased items he would have the coins in his hand and look at them there. In the last observation he laid them all out on the counter in a row and then pushed

the coins one at a time towards the shopkeeper. He also didn't look at the shopkeeper, more at the coins on the counter. In the probe before three coin problems were taught, in the complex two coin problem he gave a 20¢ coin and then said the store keeper "I can't remember", referring to the appropriate next coin. He had all of the coins laid out in a row for this module too.

Summary

The results for Subject P show that he achieved criterion on all tasks using the CAL system, and transferred and maintained one coin skills. However, no transfer occured for any other skills.

3.3.7 *Summary of Results*

All subjects reached criterion on all tasks using the CAL system, and one coin skills were transferred and maintained by all subjects. However, transfer of more advanced money skills was erratic with no conclusive evidence for transfer. The anecdotal information points to some possible explanations for this lack of transfer, and these will be presented in the discussion.

Generally there was a high correlation between stable baseline scores on a particular task and the subjects' first score on that task.

3.3.8 *Activity Preference Test*

Subject	A	F	I	M	P
Score during intervention (out of 5)	4	4	4	4	3
Score before intervention out of 5)	3	3	1	4	0

Table 3-4: Activity Preference Scores for Money Skills

Subjects A, F, I and P's preference for money skills increased with respect to the preliminary questionnaire. The largest increase was from subjects I and P who selected it four times, rather than one, as earlier in the research. No change occurred in subject M's rating.

When subjects I and P were presented with the 'money skills' option, they queried if the researcher meant money skills on the computer. Subject F asked if the researcher meant "money skills at the University".

3.4 Post-Intervention Tests

3.4.1 Money Skills Test

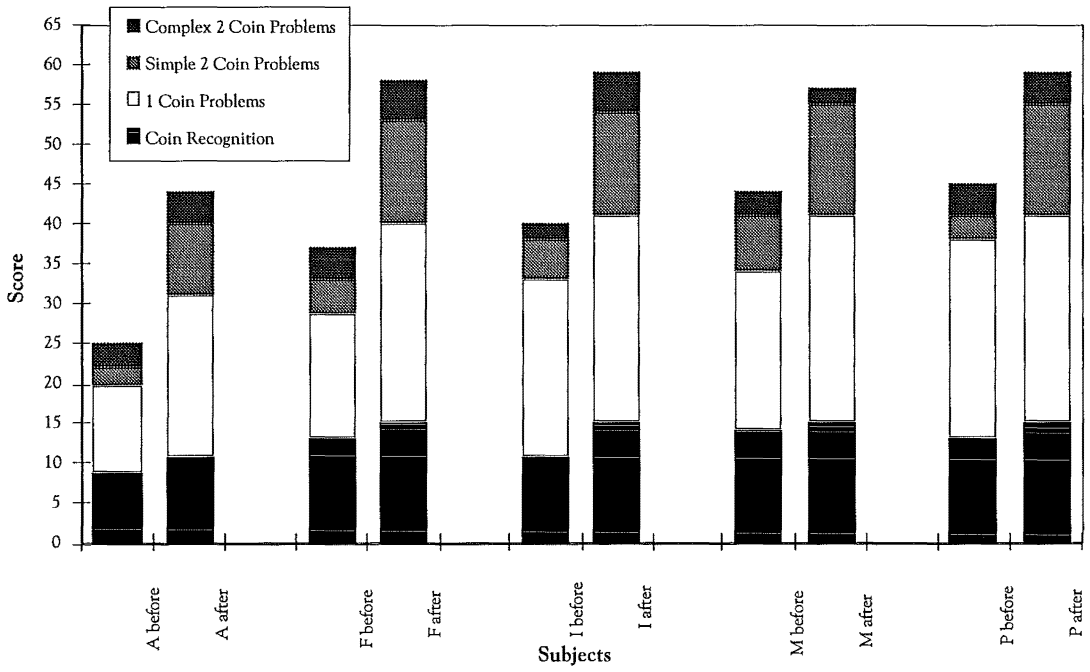


Figure 3-7: Pre- and Post Money Skills Test Scores

Figure 3-7 graphs the performance of the chosen subjects in the money skills test before and after intervention. All subjects improved between the first and second test. The scores ranged from 43-59 in the post-test, compared with 25-45 in the pre-test.

When ranked by pre-test score, all subjects apart from M remained in the same position relative to other subjects. All subjects, except M, improved in all four question groups. The complex two coin problems posed the greatest difficulty for subjects. The increase in scores recorded here between the pre- and post-tests replicate the results of Brebner et al. (1980) and Emslie (1991). This is an interesting result, given the lack of transfer in the real world, and will be addressed in the discussion.

It is interesting to note that while the test was carried out in the same setting using the same procedure as the preliminary test, all subjects referred to the CAL system, with some actually presenting behaviour similar to the CAL system. The most obvious connection was made by subject P, who used coasters as "stop" and "go" buttons. For example, if he pushed the wrong coin he would press a "stop" coaster and then take the

example, if he pushed the wrong coin he would press a "stop" coaster and then take the coin back. Subject I asked during the test if he could have a computer at home, as he missed the CAL system. Subject A commented that the items were the same as the ones to be purchased in the CAL (e.g. a Moro bar, ruler etc.). All subjects pushed the coins towards the researcher using one finger, as the system did, which they did not do in the pre-test.

3.4.2 *Activity Preference Test*

Subject	A	F	I	M	P
Score after Intervention (out of 5)	4	5	5	3	4
Score during Intervention (out of 5)	4	4	4	4	3
Score before Intervention (out of 5)	3	3	1	4	0

Table 3-5: Activity Preference Scores for Money Skills

Table 3-5 shows each subject's activity preference scores after participating in the CAL program. Scores ranged from 3 to 5 (5=maximum intent). This test was administered prior to but on the same day as the money skills test.

Three subjects' preferences for money skills increased by one, one stayed the same and one dropped by one. This indicates that in general, preferences to learn money skills increased once involved in the CAL program.

3.4.3 *Social Validation and Acceptability Questionnaire— Satisfaction Level of Subjects*

Table 3-6 summarises the yes/no or rating responses from the subject questionnaire and is followed by a summary of the comments made on the questionnaire. The original questionnaire is located in APPENDIX N and the original results are in APPENDIX N2.

Key:
✔ = yes & ✗ = no
The scale was from ❶ = None ❹ = A lot

Subjects / Question #	A	F	I	M	P
1	❹	❹	❹	❹	❹
2	❹	❹	❹	❹	❹
3	❹	❹	❹	❹	❹
4	❹	❹	❹	❹	❹
5	❹	❶	❸	❶	❹
6	✔	✔	✗	✔	✔
7	✔	✔	✔	✔	✔
8	✔	✔	✔	✔	✔

Table 3-6: Responses from the Social Validation and Acceptability Questionnaire

Question 1: ***How important do you think using money correctly is for you?***

All subjects answered that money skills was very important for them, giving a rating of ❹. Subjects A, F and P did not elaborate on their answer. Subject I said that he was "more aware of money now".

Question 2: ***Do you think that this training program helped you to improve your money skills?***

This question also yielded a rating of ❹ from all subjects. Subject A did not comment on her response. Subjects F and I attributed their improvements to more confidence since completing the course. Subject M said the she was more careful with money now, and expected change more than she used to.

Question 3: ***Has the training program made you more careful when using money?***

The top score of ❹ was given by all subjects. All but subject A, elaborated on their answer. For instance, subject I said "I know what notes and coins to use in the shop".

Question 4: ***Have you enjoyed this program to help you with your money skills?***

All comments were positive, with all subjects giving ❹ as their answer. Subject A stated that she "...really liked the computer and learning about money". Subject F said that he enjoyed the course "very much" and that he'd like to do it again.

Question 5: ***Did the course go too quickly or too slowly?***

The answers reflected that all subjects did not want the course to stop, however the ratings varied. Subject A gave a ❹ and said that she'd "like the course to go longer". Subject P also said that the course went too quickly, also giving a ❹. Subjects F and M both gave a ❶, yet they said that they wished the course was longer.

Question 6: ***Would you like the course to be done in a group?***

Four of the five subjects said that they would prefer the course to be done in a group. Subject A and F said that they liked the competition, with subject F saying "I like people there, I like beating them".

On the other hand, subject I said "I like going with the teacher only". He was the only subject who said he would like the course done not in a group.

Question 7: ***Would you like to be involved in research like this again?***

All subjects stated that they would like to be involved in work like this again. Subject F expressed interest in any course which used a computer.

Question 8: ***Would you tell your friends to take this course?***

All subjects said that they would tell their friends to take the money skills course. Subject F said that he'd like his friends to take it "so they feel good about money too". The other four subjects did not elaborate on their response.

Question 9: ***Have you any additional comments?***

All of the additional comments were positive. Subject F when asked if he had anything to add that he "enjoyed the pictures and the music" in the CAL. Subject I said that he "felt good going to money skills" and subject M said that she thought "the course was fun" .

3.4.4 *Social Validation and Acceptability Questionnaire— Satisfaction Level of Primary Care-givers*

Table 3-7 summarises the yes/no or rating responses from the primary care-giver questionnaire and is followed by a summary of the comments made on the questionnaire. The original questionnaire is located in APPENDIX M and the original results are in APPENDIX M2. All care-givers were happy to complete the questionnaire, and returned them promptly. All care givers gave rankings, and elaborated for the majority of questions.

Key
✔ = yes & ✗ = no
The scale was from ❶ = None to ❼ = A lot

Subjects / Question #	A	F	I	M	P
1	❼	❼	❼	❼	❼
2	—	❺	❻	❻	❼
3	❻	❼	❼	❺	❼
4	❸	❷	❻	❼	❼
5	❹	❹	❹	❹	❹
6	✔	✗	✗	✗	✔
8	✔	✔	✔	✔	✔
9	✔	✔	✔	✔	✔

Table 3-7: Social Validation and Acceptability Questionnaire: Primary Care-givers

Question 1: ***How would you rate the importance of money skills for the intellectually handicapped who are based in the community?***

All five care-givers rated money skills as being very important for people with IH, each giving a ❼. Subjects A, F, and I's care-givers said that it was important as it would help them become independent. F's care-givers stated that "clients need to feel confident and have the skills to shop independently".

Question 2: ***Do you think that the participants gained enough knowledge in their money skills in this training program?***

Ratings for this varied between subjects. Subject F's primary care-giver gave a rating of ❺, subjects I and M's gave a ❻ and subject P's was a ❼. The comment from subject M's care-giver was that she had noticed "a big improvement in the [subjects] confidence in using money independently".

A's care-giver did not choose to give a rating but did comment, saying "My client coped well with the computer course, but had difficulty with 'real money'".

Question 3: ***How satisfied are you with skills taught to your client in this training program?***

Three of the primary care-givers gave a rating of ❼ (very pleased) and one a rating of ❻. A's care-giver's response was typical of the written responses: "I was extremely satisfied and really impressed with my clients' progress".

Question 4: ***Have you noticed any other changes (aside from money handling) in your client's overall behaviour since they began this program?***

There was a wide range of ratings for this question, from a ❷ (no, not really) through to a ❼ (yes, indeed). The care-giver who gave a rating of ❷ stated that their subject was "...already a capable young man". The care-giver for subject P who gave a ❼ elaborated on their answer by saying that he was "much happier person overall and able to communicate openly with others. Also helped overcome heights phobia".

Question 5: ***Did the course move too fast? Too slowly?***

All primary care givers gave a rating of ❹. The comments were all along the same line, stating that "the client had no trouble keeping up. He never complained about having to attend". Subject M's care-giver stated that the course was "slightly fast, but it would be beneficial to repeat the last half for subject M".

Question 6: ***Would you like the course to be done in a group?***

Care givers were divided when answering this question. Two care-givers ticked it and three did not. The two that did cited that it would help make friendships and that they would "encourage one another".

The three care-givers who did not like the idea of going in a group stated that their subject did not "receive much one on one as he should" (subject F), "often in IHC homes it is very difficult to give one on one to clients" (subject I), and "one on one is more effective and group activities tend to lead to distractions" (subject M) .

Question 7: ***How do you think that this program could be improved (eg. additional information, practice, timing and sessions/sections, etc...)?***

There were some very constructive comments from this question. One primary care-giver suggested that some "exercises for the client to do at home to reinforce what has

been learnt". Another care-giver said that it would have been great to be invited to see where they were learning and find out a little more about the CAL system.

Question 8: *Would you allow your client to be involved in research like this again?*

This question generated much positive response from care-givers. All primary care-givers responded with ticks. One comment was that "my client enjoyed the outing, felt 'special' to be chosen and enjoyed going to the University". Subject M's primary care-giver stated that "this gave subject M a great sense of achievement".

Question 9: *Would you recommend a course such as this to other clients?*

All care-givers said that they would recommend this course to other intellectually handicapped people. One care-giver stated that "clients in all IHC homes would benefit". Another stated that her recommendation was conditional "depending on their disability".

Question 10: *Have you any additional comments?*

All care-givers gave additional comments, with all of them being on a positive note. Subject A's care-giver said "congratulations on putting together a well thought out program" and another stating that they thought that the course was good, however "we won't see the full benefits from attending this course for some months".

Discussion

"Behaviour, human or otherwise—remains an extremely difficult subject matter"
(Skinner 1969, p. 114, cited by Cooper et al., 1987, p. 31).

Research has shown that money skills can be successfully taught to individuals who are intellectually handicapped using a variety of behavioural training programs. However, there has been very little research on teaching money skills to the IH using CAL. One such study is by Brebner et al. (1980). A limitation of their research, which it shares with many other studies on CAL with people who are IH, is that they did not test the transfer of the money skills to actual purchasing situations. The purpose of this study was to test the effectiveness of CAL in producing transfer of skills from the teaching environment to the real world.

4.1 Summary of Results

The subjects were taught four tasks: to give the correct coins for one coin, simple two coin, complex two coin and three coin prices. Subjects were able to perform each of these tasks to criterion (10 out of 10), on the CAL system under three different prompt conditions (verbal only, verbal+price tag and price tag only). The subjects transferred the skills learnt to a simulated transaction (as in Brebner et al., 1980 and Emslie, 1991), yet were unable to transfer these skills consistently to the real world. That is, the CAL system developed for this study was very effective as an instructional tool to teach money skills, but the skills acquired did not transfer to the real world.

4.2 Acquisition of Money Skills

4.2.1 Baseline data

The baseline data from the intervention revealed that subjects had a very low level of ability across all tasks prior to intervention.

4.2.2 Intervention

All five subjects showed that they were able to acquire basic money skills (from one to three coin problems) when taught using the CAL system. This supports the results obtained by both Brebner et al. (1980) and Emslie (1991).

The graphs of the intervention show that learning took place, and that all subjects reached criterion on all tasks. The factors contributing to their success are discussed

below, with reference to the anecdotal notes and the information gathered in the pre- and post-tests.

4.2.2.1 Success of the CAL system

Much of the success can be attributed to the fact that the CAL system adhered to many of the guidelines for the development of both general instruction and CAL software recommended by Cohen (1985) and Williams (1990).

Integrated with the Community

When programs of instruction are being developed for people with IH there is a need to involve as many groups as possible (Williams, et al., 1990). This study involved the local IHC staff, primary care-givers and the subject's family, through the provision of a video tape of the CAL system, documentation on how the subject was progressing throughout the training and the availability of the researcher, to answer questions about the system. The primary care-givers also answered both pre- and post-tests regarding their perceptions of the course.

The staff, primary care-givers and families showed an obvious willingness to be involved and their appreciation was expressed to the researcher. The primary care-givers' responses in the satisfaction questionnaire were very positive regarding the CAL system and the subsequent skills acquired by the subjects, stating that they found the course to be both beneficial and professionally run. All primary care-givers noted an increase in self-esteem in the subjects.

In the primary care-giver satisfaction questionnaire, one care-giver said that they wished that they could have come to the University and seen the CAL system in action. An open afternoon could have been held for this purpose, as recommended by Selby (1992): "For many of the students it was the first time they had been in a position to demonstrate some expertise in a technological area to teach their parents or care-givers about anything" (p. 25). Future work could also look at training the care-givers to administer the CAL system, as it was straightforward to operate.

Self-pacing

The CAL system offered the subjects modified program control (Williams et al., 1990) over their learning (e.g. the ability to stop between modules, but not before). Subjects could choose how long they wished to work and what they wished to do while waiting for their turn using the CAL system. As a result, subject A would generally answer ten questions per visit whereas subject M would often work for an hour or two. Subjects I

and M did not like to draw and would do other things while not working on the computer. It appeared that many of their individual preferences were catered for.

All subjects needed to inform the researcher that they needed stickers (including what type) and money. All subjects apart from subject I appeared to enjoy this control and having to inform the researcher of their progress and need for reinforcers (subject I was complacent throughout the intervention).

This sort of learner control may have accounted for the boost in learner confidence (which was reported by both subjects and primary care-givers in the post-intervention satisfaction questionnaires) since attending the CAL program (Selby, 1992). Also, the control over their lesson may have made the learner feel more responsible for their learning and motivated them accordingly (Hansen, 1982).

Over Learning

The drill and practice offered by the CAL system gave opportunity for over learning to take place, as it repeated problems many times and re-presented an incorrectly answered question (Podell et al., 1992) up to three times.

Subjects were aware of the repetition of tasks, as they would comment on the fact that they had seen a particular item previously, or report that they knew the answer to a question because they had been asked it before. Subjects M and P in particular commented on the repetition.

On first consideration drill and practice might seem an inappropriate method for learning money skills, as the manipulation of coins is fundamentally an arithmetic operation, but many other studies (e.g., Nietupski et al., 1983; Gaule et al., 1985; & Fredruck-Dugan et al., 1991) also taught money skills in this way. Problems involving small numbers of coins generally do not involve arithmetic, as the combinations of coins below a dollar can be memorised and a simple rule applied to deal with problems above a dollar (it is left to the readers introspection to confirm this!) .

Active Participation

The CAL system was designed according to Skinner's views that a learner should be an active participant in their learning. The drill and practice methodology meant that the subjects were constantly required to respond to questions.

Feedback

One of the cardinal principles of both CAL and behavioural based teaching techniques is that immediate knowledge of results facilitates learning (Anderson et al., 1971). Feedback was immediate for correct and incorrect responses. When subjects were wrong an example of the correct response was also provided, including an arithmetic explanation in the form of a sum.

Money Keyboard

People with IH often have difficulty coding information. The money keyboard helped to reduce the coding required by eliminating the processing otherwise required with a regular keyboard (Brebner et al., 1980). This allowed the learners to concentrate on the program itself rather than the keyboard. Subjects found the keyboard easy to use and needed an occasional prompt explaining which keys to press and how the system worked. Subjects A, M and P were intrigued by the money keyboard, indicated by their comments about it and interest in how it worked.

Small Steps in the Modules

The antecedents were well planned, with structured modules and sequenced tasks. This structure facilitated learning and allowed learners to attend to relevant stimuli (as they knew what to expect with regard to training sequence) and to concentrate on the acquisition of money skills. Ryba (1980) states that well structured, consistent training formats provide a conceptually meaningful framework for later recall of information. The subjects would comment when there was a deviation from what they had seen before (e.g., subject M said "Oh a man...!" when a male dairy owner first appeared on the screen). Subjects M and P carefully watched their scores and relied on them being in the same place throughout the interventions to monitor their progress.

Age-appropriate Material

The items to be purchased and program format were appropriate to the age of the subjects (William et al., 1990). Going to the University appeared to be a real treat for subject P and he would often report this to the researcher. Subject I also said this to his primary care-giver (reported in the care-giver questionnaire).

Realistic Material

The antecedents were varied too, providing a large range of high quality pictures, sound, animation and speech (48 items and 60 prices), which helped keep the subjects

attentive. All subjects at some time during the course of the program would comment on the pictures. Subject I would comment on the beer and subject F on the female shopkeeper. Subject F would frequently wave at the shopkeeper that resembled his manager. Subject P said that he thought that the CAL was like television, comparing the spacecraft used as reinforcers with the television program "Thunderbirds".

Subject I once thought that the CAL system was so realistic he actually pulled money out of his wallet to pay for some cigarettes that were shown on the screen. Subject M commented on how she had shopped at one of the dairies and pointed to where she had parked.

Holds Learners Interest

All subjects were very attentive throughout the CAL. During subject P's first interaction with the machine he thought hat Superman was coming. He always looked forward to finding out what the item to purchase would be and which dairy it would be in. Subject A wanted to know where the noise came from, and looked for its source during the training. When subject F heard the ABBA song (which was the theme for the CAL program) on television, he reported this to the researcher. This indicated an interest in the CAL system outside of the lab. Subject F also spontaneously drew pictures of the system and researcher.

The increasing activity preference (apart from subject M) and high subject satisfaction questionnaire scores also indicate that the subjects enjoyed the CAL system. Subject M noticed the repetition of dairies and items, and this may account for her drop of one point in the activity preference questionnaire from the pre- to post-test.

4.3 Transfer of Training

4.3.1 Simulated Purchasing Situations

All subjects' performance improved by a significant amount between pre- and post-tests in the purchasing simulation (money skills test). This is encouraging, as it replicates the results of Brebner et al. (1980) and Emslie (1991). The money skills test avoided the negative influences present in actual purchasing situations (see below), and the marked difference in transfer between these two environments underlines the significance of these influences. All subjects discussed the CAL system during the money skills post-test, indicating that they understood the connection between them.

4.3.2 *Actual Purchasing Situations*

"Formerly, most programs could be characterised as providing instruction on nonfunctional, paper/pencil tasks which have little, if any, direct application to real-world demands"
(Nietupski, Welch, & Wacker, 1983, p. 279).

There is little point in teaching skills such as money skills and merely hoping that the subjects will be able to transfer them to real purchasing situations. People who are IH need money skills in order to participate fully in the community. They are skills which open up many doors for people who are IH.

Results of this study do not confirm the assumption that results from a simulated test apply to real world interactions (as in Brebner et al. 1980, & Emslie, 1991).

It was found that a high degree of transfer regularly occurred on the one and simple two coin tasks for all subjects. However results indicate that transfer did not occur for both complex two coin and three coin problems. Any transfer that was observed on these tasks was erratic. There are many factors that could explain this poor transfer. These are discussed below.

4.3.2.1 Time Pressure

There was no time criterion built into the CAL system, but in the real world of queues, busy customers and busy shopkeepers, there are inherent time restrictions.

The times that were noted for subjects to find coins in the dairies did not necessarily reflect their speed in solving a problem. Rather it generally marked when the shopkeeper gave in and helped the subjects due to, for example, a number of people waiting to be served. All shopkeepers helped the subjects from time to time despite being asked both before and during the probes to let the subjects work out the appropriate coins without help. One store, used in the fourth probe, was the best at allowing subjects take a long time (e.g., Subject M took 1 minute 45 seconds to work out the three coin problem), as the store was not particularly busy. The subjects performed comparatively well during this probe.

Podell et al. (1992) found that the difficulty that students who are mildly handicapped have in developing automaticity relates specifically to lack of speed, rather than lack of accuracy. Both speed and accuracy are important in the transfer of money skills, as transactions are expected to take place quickly.

There are two possible explanations for this. The difference position (Ellis & Cavalier, 1982), suggests that the limited processing capabilities of learners who are mildly mentally handicapped may prevent automaticity from being reached despite additional practice (Podell et al., 1992).

Another explanation is offered by (Hodapp, Burack, & Zigler, 1990), who suggest that, given additional practice, individual who are mildly mentally handicapped should meet the fast response times of their non handicapped peers (Podell et al., 1992). This is called the developmental position.

Solutions & Future Work

The CAL system could offer more practice to determine if this helped achieve automaticity, and therefore 'appropriate' timing in real purchasing situations. Subjects may need more explicit and extended instruction than was designed for this study in order to transfer skills to the real world.

Time criteria were not included in the intervention and no "appropriate" behaviour training was given. Perhaps a time criterion should be included in the CAL, to put learners under pressure as in actual purchasing situations. For example, Podell et al. (1992) gave their subjects 100 seconds to solve 20 problems. The time criterion could be phased in when the subject achieves the accuracy criterion, and faded once they have achieved automaticity (Criswell et al. 1984).

4.3.2.2 Distractions

Another possible explanation for transfer not occurring in dairies is that there were usually distractions (e.g. a radio/TV and customers entering and leaving the store). Attention difficulties are prominent in people who are IH, as they have difficulty distinguishing relevant from irrelevant stimuli (Ryba, 1980). From observation of the video, it was noted that other customers entering the store were a distraction and subjects inevitably turned to look at them. The two probes where the dairy was relatively quiet were the fourth and sixth probes, which yielded the best results from all subjects.

Solutions & Future Research

The CAL modules could begin without irrelevant stimuli and gradually introduce distraction as subjects reach criterion, thus teaching them to answer problems in an environment more closely resembling the real world. A laptop computer could be used to train subjects in the real world, so that subjects learn the skills with all of the real world distractions.

4.3.2.3 Age of Subjects

Most money skills studies are done with adolescent subjects (Frank et al., 1980). In contrast, all subjects who participated in this study were adults, and this may have contributed to their difficulty in transferring money skills, as they have had a long history of relying on others to help them. All subjects relied on the shopkeepers at times for help, for instance by initially offering the store keeper all of their coins (especially subjects A and I). Transfer may need to be worked on over a longer period of time in order for subjects to unlearn the exhibited helplessness behaviour.

Subject A demonstrated this learned helplessness very strongly in the fifth observation which took place in her local dairy. The results indicate that she did not transfer for any task except the one coin on this probe. This could be because she knew the woman serving her and she assumed that the purchases would progress as in the past, with subject A relying totally on the shopkeeper for assistance.

Solutions & Future Research

The CAL training could be done in conjunction with training in appropriate purchasing behaviour. Future research could examine if there is any difference in the ability for this CAL system to produce transfer in subjects who are younger (e.g. primary school age) than the subjects who participated in this study.

4.3.2.4 Prior Experience

Preliminary variables that could be considered include not only the subjects' age and developmental level but also their academic achievement, background, prior experience, and instructional history (Wynn, 1992). Subject A's despair when she got problems wrong may be attributed to a background of failure in school. In contrast, subjects M and P's determination to 'beat the system' may be attributable to a number of past successes.

Solutions & Future Research

It may be necessary to obtain a very comprehensive history of subjects and tailor programs accordingly.

4.3.2.5 Reinforcement between modules

Whether or not subjects had the opportunity to use money between CAL sessions may have influenced transfer; practice may have reinforced what they were learning. Subject F often had the occasion to use money, whereas subject A very rarely did and this additional reinforcement may have contributed to subject F's higher level of transfer.

Solutions & Future Research

A possible solution (suggested by care-givers in the satisfaction questionnaire) would be to ask care-givers to send subjects to the shop regularly and purchase an item corresponding to the module being taught at that time using the CAL system. The subjects could also be tested by care-givers on simulated transactions as homework, to reinforce the skills being learnt.

4.3.2.6 Behavioural

Subjects may have self-defeating explanations for their failures and couch them in extremely personal terms (e.g. "I'm a dumb person and nothing that I do matters") . Subjects with this attitude may need more positive reinforcement than other subjects. Subject A may have needed more positive feedback and shorter modules than was offered in this system, in order to increase her self-esteem, as she initially perceived the consequence of an incorrect response as a personal attack.

The ability to use money fluctuated across probes. Their behaviour appeared to be influenced by mood and frame of mind. For example, subject I did not seem to be motivated to respond correctly to problems in the dairy.

Solutions & Future Research

It may be necessary to implement supplementary cognitive-behavioural exercises (via the computer) to identify and alter helpless and self-defeating cognitions.

4.3.2.7 Sampling Techniques

Probes were often difficult to perform. Each probe involved obtaining the dairy owner's permission, asking them not to help and telling them what prices to charge, setting up standardised 'pocketfuls of change', organising a third party to record the probe on video tape, and sending each subject into the store four separate times. For the shopkeeper the probes disturbed the running of the shop, as the subjects took more time than regular customers, and often held up queues. This meant that they could not be done more than once between interventions.

The small number of probes increases the chance of statistical anomalies. The money skills test (Emslie,1991) was much more reliable in this respect, as results were averaged over a large number of problems.

Other problems with the probes included the automatic reaction of shopkeepers to help the subjects, and to make allowances for their handicap.

Solutions & Future Research

One solution might be to simulate the real world in the probes, but more realistically than Brebner et al. (1980) or Emslie (1991). A trained assistant could act as a shopkeeper in a real store after hours. Busyness and distractions could be simulated with the aid of several other assistants. This would act as an intermediate step until time and accuracy criteria were met, after which the subjects could be tested in the real world. It should be noted, that simulations often need to be quite elaborate to provide transfer.

Simulations have merit, especially when paired with actual site training. Additionally, if the simulated conditions are arranged to meet general case specifications, and at least some in vivo training provided, the probability for transfer of training is enhanced (Westling et al. 1988).

4.3.2.8 Scope of the training

"Learning one aspect of anything never means that you know the rest of it"
(Baer, 1981a, p1, cited by Cooper et al., 1987, p. 567)

This study set out to test transfer of training to actual purchasing situations, given similar CAL intervention to Brebner et al. (1980) and Emslie (1991). The type of training given was restricted in the same way as their studies, in the interests of replication (apart from Emslie's (1991) exercises in giving change, which are not fundamentally different from the coin skills in this study). It would seem, however, that the factors that influence transfer are broader than basic coin skills, and that the CAL system should be used in a broader program of training to include appropriate purchasing behaviour (as in Gaule et al., 1985) and time criteria (Podell et al., 1992).

Solutions & Future Research

CAL to teach real world money skills may need to be a component of a full instructional program of purchasing skills, rather than a solution on its own.

4.4 Maintenance

Five and six weeks after the last intervention, all subjects' transfer of skills (apart from subject P) was re-tested to ascertain whether maintenance had occurred. Given that transfer did not occur consistently with any of the subjects, the subjects' level of transfer was as expected in the follow-up probes.

4.5 Conclusion

The deinstitutionalisation of persons with intellectual handicaps has increased the necessity for programmes teaching community living skills. Computer assisted learning is considered an appropriate tool for teaching those with intellectual handicaps, as it can provide solutions for many of the specific learning needs associated with an intellectual handicap.

This study set out to ascertain the degree of transfer of skills from a CAL learning environment to a number of real world environments. Specifically, this study looked at money skills, as an archetypal example of community living skills which is widely recognised as imperative to successful integration into mainstream society.

A number of studies have investigated the use of CAL to teach various skills to people who intellectually handicapped, but very few have tested the ability of the trainees to apply these skills in everyday life. In much of the research there is an underlying assumption that the simulated training environments model real world stimuli sufficiently well that transfer will automatically occur.

This study was based on two earlier studies by Brebner et al. (1980) and Emslie (1991), and extended both their CAL system designs, by incorporating recent technological developments, and their experimental methodologies, by testing skill transfer in a number of actual purchasing situations.

This study replicated the success experienced by Brebner et al. (1980) and Emslie (1991) in teaching money skills using a CAL system, and found that the skills transferred to simulated transactions. Transfer to real world purchasing situations occurred for all subjects on one coin problems, was erratic on two coin problems, but was negligible across the complex two coin and three coin problems for all subjects. The results suggest that two subjects may have transferred the skills taught, given further practice using the CAL system and experience in the real world.

There are number of factors which may have hindered transfer and this study outlined some possible solutions for them, for example the introduction of a time as well as an

accuracy criterion may help learners achieve automaticity. It is crucial for future research to determine the most effective extension to facilitate transfer. Although a number of potential solutions are available, educators still need to determine which methods are most appropriate for an individual and a particular skill, and revision of the curriculum and teaching method should be ongoing.

Technologically there is still much scope for increasing the realism of the stimuli using multimedia CAL. The 'power' of the computer remains, in many ways, to be discovered through a careful analysis of innovative uses. The emerging field of virtual reality presents the possibility of very realistic simulations, involving three dimensional environments, tactile and aural stimuli and feedback.

This study shows that assumptions about computer assisted learning must be challenged and that its effectiveness on its own should be questioned.

Computation is in its infancy, and like a child, requires a great deal of attention and informed guidance in order for it to fulfil the educational promise that it holds for learners with intellectual handicaps. The use of computers in a teaching role needs to be grounded in sound psychological and educational principles, in order to maximise the benefits that it offers.

Appendix A: Letter about Participation

Kirsten Nevill-Manning,
✉ Address,
HAMILTON.
✆ Phone #

Guardian of Subject A,
Street,
HAMILTON.

Monday, February 15th, 1993

To the Guardian of Subject A,

In a short while there will be a program teaching some of the clients at Hamilton Central Branch coin usage (up to the monetary value of $6.00). Not all of the clients will be able to be included in this program. The program will be conducted by myself (Ms. Kirsten Nevill-Manning), a graduate student from the University of Canterbury, I am also a former staff member with a Christchurch branch of IHC, as part of my Masters thesis work. All people involved will also be under the guidance of their 'key' person and will be kept anonymous in my thesis.

The research will involve teaching money recognition and use with computer assisted learning. It will also involve some probe tests, and tests to see whether or not transfer has occurred in a 'natural' setting.

If you are willing to allow Subject A to participate, please cut off the form at the bottom of the page and return it to me as soon as possible. You are more than welcome to send to it the address at the top of this page, or c/- IHC Hamilton Branch, 1026 Victoria Street, HAMILTON.

If you would like further information please do not hesitate to contact either myself or Yashmin (a manager at the branch) and we will try and be of assistance.

Thank you for your consideration of this.

Yours sincerely,

(Ms. Kirsten Nevill-Manning)

✂ ✂ ✂ ✂ ✂ ✂ ✂ ✂ ✂ ✂ ✂ ✂

✦ Yes, I give permission for Subject A to be involved in the research teaching money recognition and usage with computer assisted learning.

✍ from _____

date _____

Appendix B: Needs Assessment Questionnaire — Primary Care-givers

(Based on Cooper et al., 1987)

Please answer these questions alone and honestly, to the best of your knowledge. Any additional information you may have would also be appreciated. Please write this in the 'Comments' part of the question.

Name: _____

Subject's Name: _____

Relationship to Subject: _____

Date: _____

❖ ***Does the lack of money skills entail any danger?***

❑ Yes ❑ No

Comments: _____

_____

❖ ***How many opportunities would*** *name of subject* ***have to use this skill?***

None A lot

❶ ❷ ❸ ❹ ❺ ❻ ❼

Comments: _____

_____

❖ ***How long-standing is the need for this new skill?***

_____

_____

❖ ***How will this behaviour aid other aspects of*** *name of subject's* ***life?***

_____

❖ *Does the lack of money skills draw negative attention from others?*

❑ Yes ❑ No

Comments: _____

_____

❖ *Will having money skills be beneficial for significant others in the name of subject's life?*

❑ Yes ❑ No

Comments: _____

_____

Thankyou for your participation!

Appendix B2: Needs Assessment Questionnaire—Results

All of these questionnaires were completed by the subjects primary care-giver. The results presented in this section are exactly what each care-giver responded.

The results with boxes around them, are the subjects that participated in the CAL.

Key:

✔ = yes, ✗ = no

S = subject, R = response

Question 1: Does the lack of money skills entail any danger?

S	R	Comments
A	✗	"A shops independently in selected shops only. Storekeepers are aware of her lack of money skills and provide assistance"
B	✗	"B shops at local dairy where her lack of money skills are known. Other shopping is done with staff or parental guidance"
C	✔	No comment made
D	✔	No comment made
E	✔	No comment made
F	✗	"F is very tight with his money. Won't spend any if he doesn't have too"
G	✗	"G is quite capable of making all her small purchases"
H	✗	"H's family always help H with her money—ensures she has correct amounts etc."
I	✔	"I could easily be overcharged when buying cigarettes etc."
J		No comment made
K	✗	"Because Mother overlooks K's every-step"
L	✔	"Could be ripped off easily in the community"
M	✗	"She goes shopping frequently but accompanied by an adult"
N	✗	No comment made
O	✗	"At the moment staff ensure he gets the right amounts etc."
P	✔	"Can be ripped off easily by the public"

Question 2: How many opportunities would they have to use this skill?

Scale; ❶ = None, ❼ = A lot

S	R	Comments
A	❼	"A has the opportunity to shop during her lunch hour or before and after work Monday—Friday. Alternate weekends she goes home"
B	❺	"B has the opportunity to shop most days of the week"
C	❷	No comment made
D	❸	No comment made
E	❶	No comment made
F	❹	"1) Buys chewing gum, 2) Money for bowls, 3) Money for dancing, 4) Sundries"
G	❼	"G purchases her lunch regularly, plus purchases sweets, chippies etc, plus things like toiletries, pantyhose..."
H	❸	"1) Buys magazines, 2) bowls once a fortnight, 3) Dancing once a fortnight"
I	❸	"1) Buys smokes, 2) Money for bowls, 3) Money for dancing"
J	❼	No comment made
K	❻	"Never, at the moment"
L	❶	"Not at all that much"
M	❼	No comment made
N	❼	"Goes on many outings and has a fair sense of money value"
O	❺	"Needs constant help with money skills"
P	❸	"Buys the listener, Lotto, and lunch once a week"

Question 3: *How long-standing is the need for this skill?*

S	Comments
A	"Immediately"
B	"Now or in the near future"
C	"All his life"
D	"Most of her life"
E	"All her life"
F	"As F has very little contact with his family he would have benefited from being taught money skills at an early age. I am sure if F would have been taught he would have a better understanding"
G	"N/A"
H	"It would be helpful to H if she had money skills as she would be more independent—H would have been taught this skill later in her school years"
I	"It would have been helpful to I if he had had this skill when he started earning some of his own money"
J	"N.A>"
K	"As long as it takes"
L	"As long as it takes"
M	"Definitely needs improvement"
N	"Continual"
O	"Continually"
P	"As long as it takes"

Question 4: *How will this behaviour aid other aspects of their life?*

S	Comments
A	"Build self confidence and independence"
B	"It would make B more independent and increase self-confidence"
C	"To help budget wages"
D	"To become self independent"
E	"To be able to budget her wages"
F	"F looks after himself —a case of having too, so it is hard to answer the above. He feels confident himself in handling money, although I know he sometimes gets confused with prices etc. and how much money to hand over sometimes"
G	"All G needs is more confidence (if someone is around she asks for reassurance"
H	"It would enable H to be more independent and build her confidence"
I	"Perhaps I wouldn't overspend. I don't think I fully understands the value of money"
J	"To become more independent"
K	" ? "
L	"Hopefully to be more understanding towards the cost of things as L tends to want, want, want..."
M	"Help her when out in the community on her own"
N	"Needs to be more independent within herself—lacks motivation"
O	"Help in his ability to realise the money value"
P	"Hopefully help to be friendlier towards people, especially when shopping can be"

Question 5: *Does the lack of money skills draw negative attention from others?*

S	R	Comments
A	✔	"A will ask for assistance in a polite and friendly manner"
B	✔	"B will ask for assistance, and will be polite and courteous"
C	✔	No comment made
D	✔	No comment made
E	✔	No comment made
F	✗	"As I stated above, F feels confident, he looks 'normal' hence doesn't draw any attention"
G	✗	"G looks 'normal' and is 'confident'"
H	✗	"As she always has the correct money, I don't think negative attention is drawn"
I	✗	"I usually hands over a $10.00 note for cigarettes, that's why he always draws $10.00 out of his bank. He does this regardless of the quantity he is buying"
J	✗	"No he doesn't, as he is quite capable"
K	✗	"Not that I know of, as everything has been done for K"
L	✗	"L has always given the impression she knows the value of money"
M	✗	No comment made
N	✗	No comment made
O	✗	"I haven't noticed it so far"
P	✔	"Can irritate people who can't understand P"

Question 6: *Will having money skills be beneficial for significant others in the their life?*

S	R	Comments
A	✔	"Less responsibility for both family and staff"
B	✔	"Less responsibility for family and staff"
C	✔	No comment made
D	✔	No comment made
E	✔	No comment made
F	✗	"F banks his own money, organises his money pretty well buy himself (staff help from time to time). But money skills will definitely help F gain even further independence"
G	✔	"G often helps her flatmates with their money skills"
H	✔	"It would make it easier for parents and staff"
I	✔	"It would make it easier for staff—we wouldn't have to check up that he isn't overspending. I feel it would give him more confidence and this would have lots of spin off effects"
J	✔	No comment made
K	✔	No comment made
L	✔	No comment made
M	✔	"Certainly, as she is nearing the time for independent flatting"
N	✔	No comment made
O	✔	No comment made
P	✔	No comment made

Appendix C: Compilation of Subject Details—Results

An outline of each subject is presented below. All names have been replaced by a random selection of letters from the alphabet, for anonymity.

The information contained in the tables below was completed by the Manger(s) of the homes that each of the subjects lives, in order to maintain accuracy, and to prevent any other unnecessary information being gleaned from the subjects files. All of the subjects, when these questions were given out, were from IHC homes. All of the subjects were over twenty years of age.

The results with black lines around them, are the subjects that participated in the CAL.

Subject A

Age:	29 years
Gender:	Female
Ethnicity:	European
Medication:	Contraceptive pill
Residence:	IHC Community Home (with 3 other flat mates; 1 woman and two men), full-time supervision at her home
IQ:	Moderate Intellectual handicap
Physical Disabilities:	Limps quite a bit
Independence:	Not very, relies heavily on both staff and family
Work:	A factory, placing sorting screws and nails into jars—semi-dependant on IHC

Subject B

Age:	29 years
Gender:	Female
Ethnicity:	European
Medication:	Contraceptive Pill
Residence:	IHC Community Home (with 3 other flat mates; 1 woman and two men), full-time supervision at her home
IQ:	Moderately Intellectually Handicapped
Physical Disabilities:	None
Independence:	Relies on staff and family for assistance
Work:	An IHC factory, working primarily with wood—making furniture.

Subject C

Age:	47 years
Gender:	Male
Ethnicity:	European
Medication:	Sedative medication and epileptic pills
Residence:	IHC Community Flat (with 2 other flat mates; one male, one female), part-time supervision at his flat
IQ:	Moderate
Physical Disabilities:	Epilepsy
Independence:	Semi; Relies on staff and family for many things
Work:	IHC work shop, assembling pieces of equipment for an electronics firm

Subject D

Age:	47 years
Gender:	Female
Ethnicity:	European
Medication:	None
Residence:	IHC Community Flat (with 1 female flat mate), part-time supervision at her home
IQ:	Mildly handicapped
Physical Disabilities:	None
Independence:	Semi, needs assistence to go shopping and transport to and from work.
Work:	IHC work shop

Subject E

Age:	46 years
Gender:	Female
Ethnicity:	European
Medication:	Contraceptive Pill
Residence:	IHC Community Flat (with 1 female flat mate), part-time supervision at her home
IQ:	Mildly handicapped
Physical Disabilities:	Left side paralysis
Independence:	Semi
Work:	IHC affiliated workshop

Subject F

Age:	32 years
Gender:	Male
Ethnicity:	Fijian & European
Medication:	None
Residence:	IHC Community Home (with 3 other flat mates; 2 women and 1 man), part-time supervision at his home
IQ:	Mildly Handicapped
Physical Disabilities:	Slight speech impediment
Independence:	Very capable, does his own banking etc.
Work:	Trucking company—independent of IHC.

Subject G

Age:	29 years
Gender:	Female
Ethnicity:	European
Medication:	Contraceptive Pill
Residence:	IHC Community Home (with 3 other flat mates; 1 woman and two men),part-time supervision at her home
IQ:	Mildly handicapped
Physical Disabilities:	None
Independence:	Semi: does own shopping, organises her own transportation etc.
Work:	Supermarket packer and trolley mover at a local supermarket

Subject H

Age:	38 years
Gender:	Female
Ethnicity:	European
Medication:	Epilepsy pills & mild sedatives (at times)
Residence:	IHC Community Home (with 3 other flat mates; 1 woman and two men), part-time supervision at her home
IQ:	Moderately Handicapped
Physical Disabilities:	Epileptic & partial paralysis down one side
Independence:	Semi; relies on staff and family for all monetary things and many physical tasks (eg, ironing).
Work:	Creche cleaner—independent of IHC

APPENDIX C

Subject I

Age:	34 years
Gender:	Male
Ethnicity:	European
Medication:	None
Residence:	IHC Community Home (with 3 other flat mates; 2 women and one man), part-time supervision at his home
IQ:	Mildly handicapped
Physical Disabilities:	Mild speech impediment
Independence:	Semi; able to organise his own transport.
Work:	Cleaner for a steel factory—independent of IHC

Subject J

Age:	39 years
Gender:	Male
Ethnicity:	European
Medication:	Epileptic Pills, mild sedative
Residence:	IHC Community Home (with 3 other flat mates; 1 woman and two men), full-time supervision
IQ:	Moderately handicapped
Physical Disabilities:	Epilepsy
Independence:	Semi
Work:	Builds wooden toys—independent of IHC

Subject K

Age:	38 years
Gender:	Female
Ethnicity:	European
Medication:	Epilepsy pills, anti-depressants & contraceptive injection
Residence:	IHC Community Home (with 4 other flat mates; 2 women and two men), full-time supervision at her home
IQ:	Moderate
Physical Disabilities:	Epilepsy (mild) and mood swings
Independence:	Not very, relies heavily on staff and parental supervision
Work:	An IHC factory

Subject L

Age:	20 years
Gender:	Female
Ethnicity:	Maori
Medication:	Contraceptive pill
Residence:	IHC Community Home (with 4 other flat mates; 2 women and two men), full-time supervision at her home
IQ:	Mildly handicapped
Physical Disabilities:	None
Independence:	Very, able to use public transport and purchase some small items for her personal use etc.
Work:	Kohanga Reo, and IHC workshop

Subject M

Age:	26 years
Gender:	Female
Ethnicity:	European
Medication:	Contraceptive pill
Residence:	IHC Community Home (with 4 other flat mates; 1 woman and three men), full-time supervision at her home
IQ:	Moderate
Physical Disabilities:	None
Independence:	Semi; able to organise her own transportation, but relies on family and staff for buying things.
Work:	A sheltered workshop factory and clerk for Department of Education (part-time)

Subject N

Age:	29 years
Gender:	Female
Ethnicity:	European
Medication:	None
Residence:	IHC Community Home (with 4 other flat mates; 1 woman and three men), full-time supervision at her home
IQ:	Moderate
Physical Disabilities:	20% vision in one eye and none in the other
Independence:	Relies on staff and family a great deal due to her visual impairment
Work:	An IHC workshop

Subject O

Age:	33 years
Gender:	Male
Ethnicity:	European
Medication:	None
Residence:	Heavily reliant on both staff and his family for asistence.
IQ:	Sever IH
Physical Disabilities:	Partial Parlysis
Independence:	Semi to poor
Work:	IHC workshop

Subject P

Age:	29 years
Gender:	Male
Ethnicity:	European
Medication:	Vitamin replacement pills and acne medication
Residence:	IHC Community Home (with 4 other flat mates; 2 women and two men), full-time supervision at his home
IQ:	Moderate
Physical Disabilities:	Communicates very little by speech
Independence:	Semi; able to use public transport, relies on staff and family for many other day-to-day needs
Work:	IHC work shop, assembling pieces of equipment for an electronics firm

Appendix D: Activity Preference Test

(Based on Karen et al., 1985)

The participants' preferences for learning money skills were determined by being asked questions about what daily activity they would wish to participate in. It was administered orally within a paired-comparison format. This test was administered prior to, during and after the program, for each of the subjects.

Name: _____

Date: _____

Time start: _____

Time finish: _____

Name of test administrator: _____

"Hello and welcome. My name is** name of administrator. **I'll read out two activities, and I want you to tell me which one you prefer. Please think about your answer.

O.K. *let's start. If you had a choice between [task from the left column] **and** [task from the right column] **which would you rather learn?"***

Substitute the following pairs of activities in the spaces above, and note the subject's responses. Keep your tone of voice even, not emphasising any particular option. Tick the box next to the subject's response.

✔			✔
	sweeping out the garage	mowing the lawn	
	using the washing machine	managing money	
	evacuating in the case of a fire	mowing the lawn	
	using the phone	learning how to use money	
	washing dishes	using the washing machine	
	learning how to use money	cleaning the toilet	
	hanging washing on the line	using buses	
	using buses	managing money	
	sweeping out the garage	using the phone	
	washing dishes	using buses	
	getting groceries	evacuating in the case of a fire	
	use the buses properly	use money properly	

"Thanks for answering these questions"

Appendix E: Money Skills Test

(Based on Emslie, 1991)

This test determines the participants' ability to recognise coins. It is used to decide which participants would benefit from the program. At the same time, their ability to recognise shapes and numbers is tested, to indicate whether they have the basic skills that the program assumes.

The test has 7 parts:

- Shape and price tag recognition
- Recognition of a coin from a spoken denomination
- Recognition of a coin from a spoken item value
- Recognition of a coin from a price tag
- Selection of two coins to buy an item (spoken value)
- Selection of two coins to buy an item (price tag)
- A random selection of problems from earlier exercises

This test will be administered prior to, during and after the program, for each of the subjects, to help determine progress in recognition and appropriate usage of coins.

This differs from Emslie (1991) in that they money and items are 'real', and it does not require any written response from the subjects. This test has forty more questions than Emslie (1991) had in hers. The test is administered in as near to a real-life setting as possible, with realistic prices for items, and actual transactions of coins.

As in Emslie(1991), there are a set number of coins to choose from, simulating a 'pocketful' of change, this varies from two coins to eight coins.

Recommended timing:

Approximately half an hour for the test itself and any preparation time needed.

Number of participants:

The test could be administered to a group or to individuals. In this study it was given to individuals in order to avoid distractions, and any opportunity for cheating.

Setting:

The test could be administered almost anywhere. Where it is carried out depends on the number of participants included in the test. Make sure that the participants are comfortably seated at desks. and that the room is well lit and ventilated.

Resources:

- supervisors instructions to read out and write answers on
- pen
- two sets of coins (5c, 10c, 20c, 50c, $1, $2)
- items to be priced (eg. chips, Moro bars...)
- video recorder/tape recorder if you wish to record some of these sessions

APPENDIX E

Name: _____

Date: _____

Time started: _____

Time finished: _____

Name of test administrator: _____

*"Hello and welcome, **name of subject**, my name is **name of administrator**. I'm going to teach some of you about how to use money, and I need to find out how good you are already. I'll ask you some questions, and I'd like you to answer them as well as you can. I won't tell you whether you're right or wrong until we finish all the questions.*

Do you have any questions which you would like to ask before we begin?"

"Let's begin....

The first thing that I would like each of you to do is mark, it can be any sort, on the top right hand side of the page that you have in front of you. Thanks".

For each question, lay out the coins, shapes or tags in the order given (from left to right), show the item to be purchased, if any, and ask the question given in italics at the top of each knew section. Regardless of the response, say "thanks". Do not give the participant any feedback as to the correctness of their answers until the end of all sixty-five questions.

Shape and price tag recognition

"Please give me the (shape/coin value)."

No.	Shape/Tag Value	Available Shapes	Response (¢/$)
1	Circle	Circle, Square, Star	
2	Square	Square, Oblong, Triangle	
3	$1	$1, 20¢, 50¢, $2	
4	10¢	$1, 10¢, 50¢	
5	20¢	20¢, $1, 10¢, 5¢	

"Thanks, let's go to another lot of questions"...

Recognition of a coin from a spoken denomination

"Please give me the (coin value) coin"

No.	Coin Value	Available Coins	Response (¢/$)
6	50¢	50¢, 10¢, 20¢, $2	
7	20¢	10¢, 20¢, 50¢, 5¢, $1	
8	5¢	10¢, 20¢, 50¢, $2, 5¢	
9	10¢	$1, 10¢	
10	$1	20¢, $1, 10¢, 5¢	
11	$2	$2, 10¢, 20¢, 50¢, $1	
12	20¢	20¢, 10¢, $1, 5¢	
13	10¢	$2, 10¢, 5¢, 50¢	
14	$2	50¢, 5¢, $2	
15	50¢	50¢, 5¢, $2, 10¢	

Recognition of a coin from a spoken item value

"This (item) costs (item value). Please give me the coin would you use to buy it?"

No.	Item	Item Value	Available Coins	Response (¢/$)
16	Mintie	5¢	5¢, 10¢, 20¢, $2, $2	
17	Die	10¢	10¢, 20¢, 50¢	
18	Chips	$1	10¢, $1	
19	Choc Fish	50¢	$1, 10¢, 5¢, 50¢, 20¢	
20	Pencil	20¢	20¢, $1, 10¢, 5¢, $2, 50¢	
21	Moro Bar	$1	$2, 20¢, $1	
22	Banana	50¢	50¢, 10¢, $1, 5¢	
23	Giant Pebble	10¢	$2, 10¢, 5¢, 50¢	
24	Stockings	$2	50¢, 10¢, 5¢, $2, 20¢	
25	Coke Can	$1	50¢, 5¢, $2, $1	

Recognition of a coin from a price tag

"Here is a/an (item) with a price tag. Please give me the coin that you would use to pay for it"

No.	Item	Item Value	Available Coins	Response (¢/$)
26	Fanta Can	$1	5¢, 10¢, 20¢, $1, 50¢	
27	Card	$2	10¢, 20¢, $2, 5¢	
28	Apple	50¢	10¢, 50¢, $1	
29	Hersheys' Kisses	$1	$1, 10¢, 5¢, 50¢, 20¢	
30	Marble	10¢	20¢, $1, 10¢	
31	Ruler	50¢	$2, 50¢, 20¢, $1, $1	
32	Crayon	20¢	50¢, 20¢, $1	
33	P.K. Gum	20¢	$2, 10¢, 20¢	
34	Writing Pad	$2	10¢, 5¢, $2	
35	Listener (magazine)	$2	50¢, 5¢, $2, $1, 20¢, 10¢	

Selection of two coins to buy an item (spoken value)

"Here is a/an (item) which costs (item value). Give me the two coins you would need to give to the shopkeeper if you wished to buy it"

No.	Item	Item Value	Available Coins	Response (¢/$)
36	Orange	70¢	50¢, 10¢, 20¢, $1, $2	
37	Extra (Gum)	40¢	20¢, 20¢, $2	
38	Cheeseburger	$1.50	10¢, 20¢, 50¢, $1	
39	Card	$2.20	$2, 10¢, 5¢, 20¢, 50¢, 50¢	
40	Hair Clip	$1.10	20¢, $1, 10¢	
41	Banana	30¢	$2, 50¢, 20¢, 10¢	
42	Scissors	$2.50	50¢, 10¢, $2, 20¢, $1	
43	Giant Jaffa	25¢	$2, 10¢, 5¢, 20¢	
44	Milk	$1.20	50¢, 10¢, 20¢, $1	
45	Bread	$2.10	10¢, 5¢, $2	

Selection of two coins to buy an item (price tag)

"Here is a/an (item) with a price tag. Give me the two coins that you would use to pay for it"

No.	Item	Item Value	Available Coins	Response (¢/$)
46	Raro Sachet	60¢	50¢, 10¢, 20¢, $1	
47	Peppy Chew	40¢	20¢, 20¢, $2, 5¢, $1	
48	Milk Shake	$3.00	10¢, $2, $1	
49	Vaseline	$1.50	$1, 10¢, 5¢, 20¢, 50¢	
50	Head Band	$2.20	20¢, $2, 10¢, 5¢, $1	
51	Tomato	15¢	$2, 5¢, 20¢, 10¢, $1, $2	
52	Tooth Brush	$2.50	50¢, 10¢, $2, 20¢	
53	Sellotape	55¢	50¢, 10¢, 5¢,	
54	Mello Yellow	$1.00	50¢, 10¢, 20¢, 50¢	
55	Cream	$1.10	10¢, 5¢, $2, $1	

A random selection of problems from earlier exercises

Use the text indicated in the 'speech' column when posing the problems

(a) *"Please give me the (coin value) coin"*

(b) *"This (item) costs (item value). What coin would you use to buy it?"*

(c) *"Here is a/an (item) with a price tag. Give me the coin that you would use to pay for it"*

(d) *"Here is a/an (item) which costs (item value). Which two coins do you need to buy it?"*

(e) *"Here is a/an (item) with a price tag. Give me the two coins that you would use to pay for it"*

No.	Speech	Item	Item Value	Available Coins	Response (¢/$)
56	(a)		50¢	50¢, 10¢, 20¢, $1, $1	
57	(c)	P.K. Gum	20¢	20¢, 20¢, $2, 5¢	
58	(b)	Moro Bar	$1	10¢, 20¢, 50¢, $1	
59	(a)		$2	$2, 10¢, 5¢, 20¢	
60	(d)	Hair Clip	$1.10	20¢, $1, 10¢,	
61	(e)	Banana	30¢	$2, 50¢, 20¢, 10¢, $1, 10¢	
62	(c)	Cigarettes	$2	50¢, 10¢, $2, 20¢	
63	(b)	Giant Pebble	10¢	$2, 10¢	
64	(d)	Milk	$1.20	50¢, 10¢, 20¢, $1	
65	(e)	2-minute noodles	55¢	10¢, 5¢, $2, $1, 50¢	

"We have completed all of the questions, thanks for answering them. Is there anything you wish to ask? Would you like to know how many you got right?"

Appendix F: Observation in the 'real world'

The subject should be given a 'pocketful' of change by the administrator, who takes them to the dairy/store. At the dairy/store, the administrator should ask the subject to go inside and purchase an item (eg. an ice block or a Moro bar).

A person should be waiting inside with a hand-held video recorder to record the subject's entire interaction in the dairy/store. Try to make this recording discreet.

At the end of the day, get two people to watch the recording independently and note the occurrences of the behaviours, and rate them according to the system outlined below.

Observation schedule

The test administrator should fill this first section out.

Date: _____

Name of subject: _____

Name of dairy/store: _____

Item tendered: _____ **Item value:** _____

'Pocketful' of change: _____

Name of observer: _____

The two independent video watchers should fill this section out.

Change tendered (state how many of each coin):

$2	$1	50¢	20¢	10¢	5¢	Total

How many weak verbal prompts did the shop keeper give?	
How many strong verbal prompts did the shop keeper give?	
How many physical prompts did the shop keeper give?	
How long did it take to find the change?	seconds

Calculation of score

The test administrator and/or the video watchers should work this section out

The subject can score a maximum of 10 points, and points are deducted from this if the subject has difficulty in the transactions:

- points are deducted from the maximum of ten, proportional to the difference in amount tendered and the item's value:

$$10 \cdot \left(1 - \frac{|\text{money given} - \text{value of item}|}{\text{value of item}}\right)$$

So, if an item costing $1.35 is bought with $1.50, where the correct change is available, the score is:

$$10 \cdot \left(1 - \frac{|1.50 - 1.35|}{1.50}\right) = 10 \cdot \left(1 - \frac{.15}{1.35}\right) = 10 \cdot 0.89 = 8.9 \text{ points out of } 10$$

- -1 for each simple more/less prompt
- -2 for each specific prompt (e.g. "Give me another 5¢)
- -1 for each physical prompt
- ∞ for many prompts (when the subject has no idea of the correct answer)

Original Observation Schedule

Originally, the schedule also included the questions:

- ❖ Did they wait for change?
- ❖ Did they ask the price of the item?
- ❖ Was the price of the item on it?
- ❖ How did the shopkeeper rate the subject's effectiveness?

After observing the video records, it was decided that these were irrelevant as:

- ❖ the subjects were not being taught appropriateness,
- ❖ they were always told the price
- ❖ they always waited for change
- ❖ shopkeepers invariably rated the subjects highly regardless of their performance

Appendix G: Description of Probes in Dairies

Probe	*Item*	*Price*	*Coins*
1	Mintie	10¢	$1, 50¢, 20¢, 20¢, 10¢, 5¢, 5¢
	Milk	$1.20	$2, $2, $1, 50¢, 50¢, 5¢
	Gum	40¢	$2, $1, 20¢, 20¢, 50¢, 50¢, 5¢
	Magazine	$3.15	$2, $2, $1, 20¢, 10¢, 10¢, 5¢
2	Gob stopper	20¢	$1,$2,50¢,20¢,10¢,5¢,5¢
	Skittles	$1.05	$1,50¢,20¢,20¢,20¢,10¢,10¢,5¢,5¢
	Chocolate bar	70¢	$2,$1,50¢,20¢,20¢,10¢,5¢,5¢
	Candy	45¢	$1,20¢,20¢,20¢,20¢,10¢,10¢,10¢,5¢
3	Lolly	5¢	$2,$1,50¢,50¢,20¢,10¢,10¢,5¢
	Milk	$2.20	$2,$2,$1,50¢,20¢,20¢,5¢
	Choc. Fish	40¢	$2,50¢,20¢,20¢,10¢,10¢,5¢
	Gum	35¢	$1,50¢,20¢,10¢,5¢,5¢
4	Candy	10¢	$1,50¢,10¢,5¢
	Potato Chips	$1.50	$1,20¢,50¢,50¢,50¢,10¢
	Choc. Fish	40¢	$2,$2,20¢,20¢,10¢
	Milk	$2.55	$2,$1,50¢,50¢,10¢,10¢,5¢
5	Lolly	5¢	$1,5¢,10¢
	Giant Jaffa	25¢	$2,$2,$1,20¢,5¢,5¢
	Milky Way	70¢	$1,$1,50¢,20¢,10¢,10¢
	Potato Chips	$1.55	$1,50¢,20¢,10¢,5¢
6	Candy	5¢	
	Candy	55¢	
	Chocolate Bar	60¢	
	Chocolate Bar	$1.25	
7	Coke	$1	$1,50¢,20¢,5¢
	Giant Pebble	25¢	$2,50¢,20¢,5¢,5¢,5¢
	Candy	60¢	$1,50¢,20¢,20¢,20¢,10¢
	Listener	$2.20	$2,$2,50¢,20¢

Appendix H: Sample CAL log file

This is a log of Subject I's log for three coin problems. The left-most number is the time-stamp in seconds since starting this session (around 20 minutes in this case).

Started Module 21 on Wednesday, 4 August 1993 at 10:28:31 AM

968.4: Item: Desserts
968.5: Cost: $1.70¢
968.7: Coins: 20¢ 50¢ 5¢ $1
977.3: Pushed coin: $1
984.8: Pushed coin: 20¢
991.2: Pushed coin: 50¢
994.6: Right

999.5: Item: Tea & Coffee
999.6: Cost: 65¢
1000.0: Coins: 10¢ 50¢ 10¢ 5¢ 5¢ 5¢
1006.8: Pushed coin: 5¢
1011.4: Pushed coin: 10¢
1015.5: Pushed coin: 50¢
1018.2: Right

1022.2: Item: Cones
1022.3: Cost: $1.25¢
1022.6: Coins: $2 $1 10¢ 20¢ 5¢ 50¢
1030.0: Pushed coin: $1
1034.8: Pushed coin: 20¢
1041.0: Pushed coin: 5¢
1043.0: Right

1045.2: Item: McChicken
1045.3: Cost: $3.50¢
1045.5: Coins: $2 $2 $1 50¢
1054.4: Pushed coin: $2
1062.5: Pushed coin: $2
1064.7: Took back the last coin
1073.2: Pushed coin: $2
1076.4: Pushed coin: 50¢
1077.3: Wrong

1104.3: Item: McChicken
1104.4: Cost: $3.50¢
1104.7: Coins: $2 $2 $1 50¢
1109.8: Pushed coin: 50¢
1113.6: Pushed coin: $1
1116.8: Pushed coin: $2
1119.6: Pushed coin: $2
1120.4: Took back the last coin
1121.8: Retry

1127.3: Item: Orange Juice
1127.4: Cost: $1.55¢
1127.8: Coins: 20¢ 5¢ $2 $1 $2 50¢
1133.6: Pushed coin: $1
1137.3: Pushed coin: 5¢
1150.4: Pushed coin: 20¢
1153.7: Wrong

1175.8: Item: Orange Juice
1176.0: Cost: $1.55¢
1176.2: Coins: 20¢ 5¢ $2 $1 $2 50¢
1184.2: Pushed coin: 50¢
1187.9: Pushed coin: 5¢
1191.6: Pushed coin: 20¢
1192.7: Took back the last coin
1195.9: Pushed coin: $1
1197.4: Retry

1203.0: Item: Filet-O-Fish
1203.1: Cost: $3.05¢
1203.4: Coins: 50¢ $2 $1 $2 20¢ 5¢
1213.7: Pushed coin: 50¢
1219.9: Pushed coin: $2
1234.1: Pushed coin: $1
1235.3: Wrong

1260.0: Item: Filet
1260.2: Cost: $3.05¢
1260.5: Coins: 50¢ $2 $1 $2 20¢ 5¢
1266.8: Pushed coin: $2
1270.5: Pushed coin: $1
1274.6: Pushed coin: 5¢
1275.7: Retry

1281.2: Item: Drinks
1281.3: Cost: $1.15¢
1281.6: Coins: 5¢ 50¢ $1 10¢ 50¢
1288.9: Pushed coin: 5¢
1300.5: Pushed coin: 10¢
1303.7: Pushed coin: 50¢
1304.8: Took back the last coin
1317.9: Pushed coin: $1
1318.9: Right

1322.6: Item: McFeast
1322.7: Cost: $3.20¢
1323.0: Coins: $2 50¢ $1 20¢ 20¢ $2
1331.3: Pushed coin: $1
1335.2: Pushed coin: 50¢
1336.8: Wrong

1358.9: Item: McFeast
1359.0: Cost: $3.20¢
1359.3: Coins: $2 50¢ $1 20¢ 20¢ $2
1365.2: Pushed coin: $2
1369.0: Pushed coin: $1
1372.3: Pushed coin: 20¢
1374.1: Retry

1379.7: Item: KiwiBurger
1379.8: Cost: $3.50¢
1380.2: Coins: 10¢ $1 10¢ 50¢ $2 $2
1396.0: Pushed coin: $2
1403.4: Pushed coin: $1
1408.0: Pushed coin: 50¢
1409.2: Right

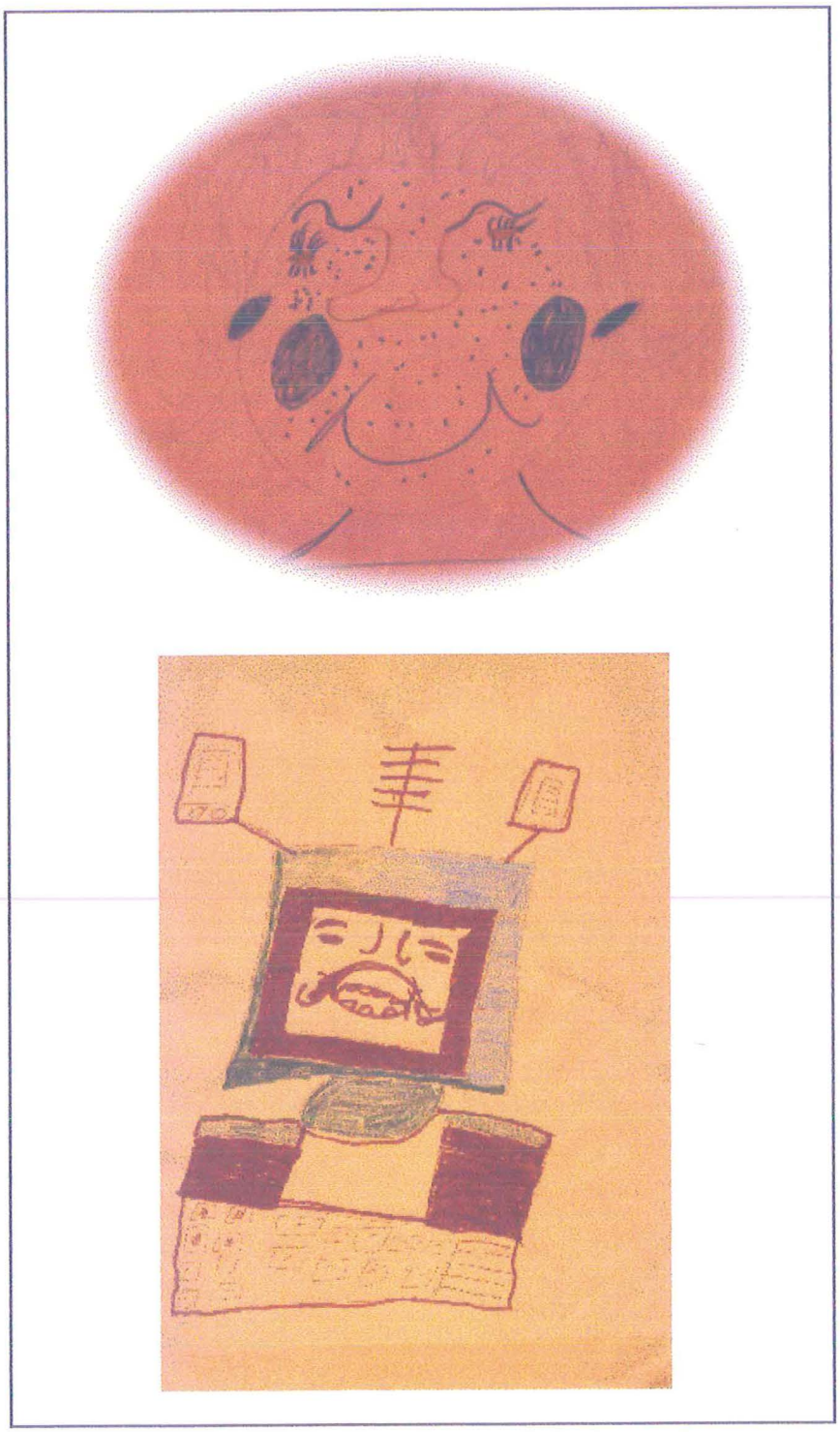
1412.8: Item: Quarter Pounder
1413.0: Cost: $3.20¢
1413.2: Coins: $1 $2 20¢ $1
1421.6: Pushed coin: 20¢
1424.5: Pushed coin: $1
1427.2: Pushed coin: $2
1429.2: Right

Score: 6 out of 10

Appendix I: Example CAL Questions

Task	*Item*	*Price*	*Pocketful of Change*
One coin	Moro bar	$1	5¢, 10¢, $2, $1, 5¢
Simple two coin	Mintie	25¢	10¢, $1, 20¢, 10¢, 5¢, 20¢
Complex two coin	Chocolate Fish	40¢	5¢, $2, 20¢, $2, 20¢
Three coin	Cheeseburger	$1.55	10¢, $2, 5¢, $1, 50¢, 20¢

Appendix J: Drawings During CAL



The subjects were able to draw during the CAL sessions. They were allowed to draw anytime during a visit to the University. This picture is one of the many drawings which reflected subjects attitude towards the CAL. The researcher never asked them to draw the CAL system. These drawings were done by subject F.

Appendix K: Care-givers Letter about Progress

Kirsten Nevill-Manning,
✉ # Street,
Suburb,
HAMILTON.
✆ Phone #

Care-givers(s) of Subject M,
Street,
HAMILTON.
Monday, May 24th, 1993

To the care-givers of Subject M,

As you are aware Subject M is involved in a program with some of the clients at Hamilton Central Branch teaching basic coin usage (up to $6.00). The research involves teaching money recognition and use with computer assisted learning (CAL). Subject M has also been involved in some tests to see whether or not transfer of this skill has/does occur in a 'natural' setting (eg. a dairy).

Subject M has come to the University of Waikato on five different occasions, since the 21st of April. I thought that since she is putting in time, and you are her primary care-givers, I should give you some written account of how she is progressing.

There are four main modules to be work through, each with three sections (a total of thirty-five questions). The modules are divided into;

One coin problems (eg. Moro bar costs $1.00)

Simple two coin problems (eg. Can of coke costs $1.10)

Complex two coin problems (eg. Candy snake costs $0.70¢)

Multiple coin problems (eg. Magazine costs $3.25)

Subject M is now onto the third section, that is, she is just over half way through. Subject M has progressed through the modules *very* quickly. The real test will be, if she is able to learn the last two modules, as they are quite difficult.

Subject M sometimes attends the course with Subject F and Subject A. The inclusion of more than one person coming to each session, accounts for why we are arriving home late some evenings. None of the people involved have to complete all of a module each time they attend. I try to allow them to work at their own pace, so some work a lot longer than others.

Subject M has been enthusiastic and chatty, on the way to, during and after the CAL. Most weeks I also give her a cup of coffee/tea, before we begin, as I am aware that she is coming straight from work, and may be tired. Some weeks I have also provided cookies for the clients to eat.

Subject M seems to enjoy working on the computer for longer periods of time than some of the other clients do. She appears to have a reasonably long concentration span for an person with IH . Subject M also responds well when she makes a mistake, and seems to be able to learn from them.

Subject M has learnt from and progressed through the CAL. I am hoping that the Subject M may be finished the second half of the CAL by mid-June (given her current rate of progress). I will inform you of when this time is drawing near.

Subject M is delightful to have as a subject, as she is so pleasant and positive. I have really enjoyed getting to know and working with Subject M. If you have any questions about anything, please do not hesitate telephoning or asking me in person.

Thankyou for allowing Subject M to be involved.

Yours sincerely,

(Ms. Kirsten Nevill-Manning)

P.S.

I have made a video of the CAL. This video is floating around IHC headquarters (Yashmin should know its whereabouts). You may wish to watch it, so that you have an idea of what Subject M is learning from.

Appendix L: Final letter to care-givers

Kirsten Nevill-Manning,
Street Name,
Suburb,
HAMILTON.
✆ Phone #

24th July 1993

To whom it may concern,

I am writing to let you know that Subject A has completed a Money Skills Program at the University of Waikato.

Subject A has been attending the course at the University over the past four months. I wanted to let you know how much energy she put in, how she did and what she has achieved.

Subject A would come to the University either once or twice each week for approximately one hour. Subject A attended the course with other people most times that she came. She appeared to enjoy chatting and drawing pictures with the other participants. The only drawback was that with more people being present at sessions, Subject A needed to come for a long period, as each person had less time on the computer.

Half way through the program as the problems became more and more difficult, Subject A got a little upset. She said things like "the man inside the computer was mean". I spent a few of our sessions together explaining that if she got a problem wrong and the computer told her about the mistake, that it didn't mean that she was dumb or that it was mad, simply that she needed to try again and learn from her mistakes. After a short while her entire attitude changed and she attempted the re-tries with much vigour!

In total Subject A attempted 60 problem sets each made up of 10 questions. This means that she answered approximately 600 problems (at least) over the entire course! Within each of these 10, she may have repeated any one question up to three times. This indicates great perseverance to me.

Subject A found the program a little difficult. I thought that this may be the case before we started as in the preliminary tests I had done (such as coin recognition and simple money problems) she got a low score. However, she did manage to complete the program on the computer.

The aim of my work was not so much to see if people improved using computer assisted learning (which she did), as seeing if they could transfer this skill to the 'real' world. After every section (there were four) on the computer I would take Subject A to a dairy (a different one each time) and video her buying items which I gave her the money for and chose. Although Subject A improved on the computer, I found that there was little improvement in a real purchasing situation. Some of the other participants were able to transfer their learnt skills to the real world while a couple of others couldn't.

My thesis spends its entire discussion section going over these points, discussing why computer assisted learning to teach basic money skills yielded this sort of result. I tried to make the computer assisted learning realistic, to help with transfer, perhaps it was not realistic enough. Another possible reason that Subject A could not use money in the real world is because she has learnt not to over the years—that shopkeepers are trustworthy. Perhaps there isn't enough incentive for her to try in a purchasing situation etc..... I could go on for a long time about the reasons, but I won't.

Regardless of the results in the real world Subject A improved on the computer and it was a pleasure to have Subject A involved. I appreciated her bubbliness and conversation. I also enjoyed watching her conquer her fear of failure and try problems again without it becoming something personal. Regardless of whether or not her money skills improved in real purchasing situations, I hope that this attitude transfers to other areas of her life. I would be keen to recommend Subject A for many teaching programs, as she certainly was a dedicated and keen student.

Thank you for allowing Subject A to be involved with learning basic Money Skills at the University. I have really appreciated her contribution to my work.

Yours Sincerely,

(Kirsten Nevill-Manning)

Appendix M: Social Validation and Acceptability Questionnaire—Satisfaction Level of Primary Care-givers

(Based on Tiong, 1990)

Please fill in this form honestly and alone. Do not talk to others while filling this out; it is your own personal opinions that count. This will help me to improve, where necessary, the course for the future. Remember, all of your information is given anonymously.

Most of the questions require that you fill answer on a scale of ❶ to ❼ . Opportunity is also given for you to expand and clarify your position if you wish.

"The greatest kindness I have to offer you is the truth"

(John Powell)

Date: _____

❖ How would you rate the importance of money skills for the Intellectually Handicapped who are based in the community?

Not important at all — Very important

❶ ❷ ❸ ❹ ❺ ❻ ❼

Comments: _____

_____

❖ Do you think that the participants gained enough knowledge to improve their money skills in this training program.

No definitely not — Yes, indeed

❶ ❷ ❸ ❹ ❺ ❻ ❼

Comments: _____

_____

❖ How satisfied are you with the skills taught to your client in this training program?

Not satisfied at all — Very pleased

❶ ❷ ❸ ❹ ❺ ❻ ❼

Comments: _____

_____

❖ Have you noticed any other changes (aside from money handling) in your client's overall behaviour since they began in this program?

Not definitely not — Yes, indeed

❶ ❷ ❸ ❹ ❺ ❻ ❼

Comments: _____

_____

❖ Did the course move too fast? Too slowly?

Far too fast — Far too slowly

❶ ❷ ❸ ❹ ❺ ❻ ❼

Comments: _____

_____

❖ Would you like the course to be done in a group? Why/not?

❑ Yes ❑ No

Comments: _____

_____

- How do you think that this program could be improved? (eg. , additional information, practice, timing and session/sections differently, etc...)

_____

_____

_____

_____

- Would you allow your client to be involved in research like this again?

❑ Yes ❑ No

Comments: _____

_____

- Would you recommend a course such as this to other clients?

❑ Yes ❑ No

Comments: _____

_____

- Have you any additional comments?

_____

_____

Thanks for spending the time filling out this questionnaire!

Appendix M2: Social Validation and Acceptability Questionnaires—Satisfaction level of Primary Care-givers—Results

All of these questionnaires were completed by the subjects primary care-givers. They completed them anonymously and alone.

Key:
✔ = yes, ✗ = no
S = subject, R = response

Question 1: *How would you rate the importance of money skills for the intellectually handicapped who are based in the community?*

Scale: ❼ = Very important ❶ = Not important at all

S	R	Comments
A	❼	"Clients need to feel confident and have the skills to shop independently"
F	❼	"Money skills are very important to all clients, but especially to those whose family don't have input"
I	❼	"It is especially essential in semi-independent homes"
M	❼	"This gives the ability to use money and know what money can buy"
P	❼	"P really looks forward to skills day"

Question 2: *Do you think that the participants gained enough knowledge in their money skills in this training program?*

Scale; ❼ = Yes, indeed ❶ = No definitely not

S	R	Comments
A	/	"My client coped well with the computer course but had difficulty with "real money""
F	❺	"The client had a lot of understanding before the course, but is now starting to talk about the costs of larger items and comparing prices"
I	❻	"I note that the client isn't using , or wanting to use $10.00 every time he purchases an item"
M	❻	"A big improvement in the confidence of using money independently"
P	❼	No comment

Question 3: *How satisfied are you with skills taught to your client in this training program?*

Scale; ❼ = Very pleased ❶ = Not satisfied at all

S	R	Comments
A	❻	"I was extremely satisfied and really impressed with my clients' progress""
F	❼	"The client has become more confident with his personal banking—is telling me the amount he wished to bank"
I	❼	"The client is more able to budget his $20.00 per week very well"
M	❺	"I do feel subject M needs to make use of similar programmes"
P	❼	"I think that he learnt a lot"

Question 4: *Have you noticed any other changes (aside from money handling) in your client's overall behaviour since they began this program?*

Scale; ❼ = Yes, indeed ❶ = No, definitely not

S	R	Comments
A	❸	"More confidence"
F	❷	"The client was already a capable young man"
I	❻	"The client appears to be more confident in himself, plus also happier and relaxed"
M	❼	"More confidence when shopping in the grocery area"
P	❼	"Much happier person overall & able to communicate openly with others. Also helped overcome heights phobia"

Question 5: *Did the course move too fast? Too slowly?*

Scale; ❼ = Far too slowly ❶ = Far too fast

S	R	Comments
A	❹	No comment
F	❹	"The client has no trouble keeping up. He never complained about having to attend"
I	❹	"The client when spoke to regarding the course stated he was enjoying and coping with the course"
M	❹	"Slightly fast but it would be beneficial to repeat the last half for subject M"
P	❹	"Subject P would have liked to keep going to money skills, as he liked it"

Question 6: *Would you like the course to be done in a group?*

S	R	Comments
A	✔	"Encourage one another"
F	✘	"The client enjoyed the one on one contact. He doesn't receive as much one on one as he should"
I	✘	"The client thoroughly enjoyed the time one on one. Often in IHC homes it is very difficult to give one on one to clients. The course to this client was a real treat, an outing looked forward too!"
M	✘	"One to one is more effective and group activities tend to lead to distractions"
P	✔	"Help P make new friendships"

Question 7: *How do you think that this program could be improved (eg. additional information, practice, timing and sessions/sections, etc...)?*

S	Comments
A	"Exercises for the client to do at home to reinforce what has been learnt"
F	"My client talks quite a bit to me,, so he kept me well informed as to what he was doing, however, if you had a client that wasn't that talkative, additional information would be helpful, so you could in turn reinforce a little as to what they have learnt"
I	"It would be good if staff could attend one session just to see clients in action, and to gain a better understanding of what they were doing. I fell the more practice the better each week the client comes shopping with me, he purchases an item from the supermarket with my money, and I ask him how much he needs and then we talk about the change"
M	"Including the unit staff in the program as this could then be used by clients and staff in an on goin program and not lose any new skills"
P	No comment

Question 8: *Would you allow your client to be involved in research like this again?*

S	R	Comments
A	✔	"My client enjoyed being involved . Thank you for the opportunity"
F	✔	"The client enjoyed the outing, felt "special" too be chosen and enjoyed going to a *University* (never been to a University before)"
I	✔	"It was just a real bonus to attend/visit the University. I was informed that was where normal, clever people go"
M	✔	"This gave subject M a greats ense of achievement"
P	✔	"Yes, subject P liked it lots"

Question 9: *Would you recommend a course such as this to other clients?*

S	R	Comments
A	✔	"Money skills are important. It helps build confidence and independence"
F	✔	"Especially to clients in a semi-independent home"
I	✔	"I feel that clients in all IHC homes would benefit"
M	✔	"Depending on their disability"
P	✔	No comment made

Question 10: *Have you any additional comments?*

S	Comments
A	"Congratulations on putting together a well thought out program"
F	"I feel a number of IHC clients would be able to be a lot more independent and confident with more one to one input. I personally feel with this client we won't see the full benefits from attending this course for some months. He is starting to nut things out a bit, and understand the value of money. He is quite a deep thinker"
I	"A lot of IHC clients have not had a lot of time spent with them individually. Often they have ways of learning and understanding things a little different, but in their own minds they have it sorted out, for example the client sorting out his $20.00—money for smokes and activities"
M	"This course does not only benefit the client but the staff and others in the future"
P	"subject P really like going to money skills"

Appendix N: Social Validation and Acceptability Questionnaire — Satisfaction Level of Subjects

(Based on Tiong,1990)

This is a verbal questionnaire. It is to be given by a person who is unfamiliar to the client, to help eliminate any biased answers (either positive or negative). It must not be given by the researcher. Make sure you present all of the options and then get them to chose one, circle the response given. It would also be beneficial to tape the responses so as to get an accurate response from each client, this could then be transcribed onto the sheet and examined in full.

Prior to giving this, make sure that the client is comfortable, in a well lit and ventilated room and at ease.

Date: _____

"The people that ran this program are interested to see what you thought of it. They plan to use any feedback you give to change any future courses based on this one.

Please try to answer all of the questions I am about to ask you. Remember to answer them honestly, as your name is not given to anyone.

Here goes...."

❖ How important do you think using money correctly is for you?

Not important at all ❶ | not that important ❷ | important ❸ | Very important ❹

Comments: _____

_____

❖ Do you think that this training program helped you to improve your money skills?

No, not at all ❶ | only a little bit ❷ | yes, mostly ❸ | Yes, a lot more ❹

Comments: _____

_____

❖ Has the training made you be more careful when using money?

No, not at all ❶ only a little bit ❷ yes, mostly ❸ Yes, a lot more ❹

Comments: _____

_____

❖ Have you enjoyed this program to help you with your money skills?

No, I didn't like it ❶ only a little of the time ❷ yes, most of the time ❸ yes, very much ❹

Comments: _____

_____

❖ Did the course go...

Not fast enough ❶ not quite fast enough ❷ a little bit too fast ❸ far too fast ❹

Comments: _____

_____

❖ Would you like the course to be done in a group?

❑ Yes ❑ No

Comments: _____

_____

❖ Would you like to be involved in research like this again?

❑ Yes ❑ No

Comments: _____

_____

❖ Would you tell your friends to take this course?

❑ Yes ❑ No

Comments: _____

_____

❖ Have you any additional comments?

_____

"Thanks for spending the time answering these questions!"

Appendix N2: Social Validation and Acceptability Questionnaires—Satisfaction level of Subjects—Results

All of these questionnaires were completed by the subjects

Key:
✔ = yes, ✗ = no
❶ = *Not* very good, ❹= excellent

Question 1: *How important do you think using money correctly is for you?*

A	❹	No comment made
F	❹	No comment made
I	❹	"I'm more ware of money now"
M	❹	"It is good to be able to use it"
P	❹	No Comment made

Question 2: *Do you think that this training program helped you to improve your money skills?*

A	❹	No comment
F	❹	"I don't feel as scared about going into a shop and spending money"
I	❹	"I'm more confident"
M	❹	She said that she was more confident
P	❹	No comment made

Question 3: *Has the training program made you more careful when using money?*

A	❹	No comment
F	❹	"I feel cheated about change at times"
I	❹	"I know what notes and coins to use in the shop"
M	❹	"I think about what money I'll use"
P	❹	"Yes, I try more"

Question 4: *Have you enjoyed this program to help you with your money skills?*

A	❹	"I really liked the computer, and learning about money"
F	❹	"Very much. I'd like to do the course again"
I	❹	"I liked the teacher very much and enjoyed learning"
M	❹	"I really liked going and I miss it"
P	❹	"Yep. I liked the computer"

Question 5: *Did the course go...*

A	❹	"I would like the course to go longer"
F	❶	"It took a long time to learn to use the computer. I would like to have my own computer one day"
I	❸	"I don't want the money teaching to stop"
M	❶	"I wanted the course to be longer"
P	❹	"I want to go back to money skills"

Question 6: *Would you like the course to be done in a group?*

A	✔	"I liked to beat subject F"
F	✔	"I like people there, I liked beating them"
I	✗	"I liked going with the teacher only"
M	✔	"It was good seeing subject F and subject A"
P	✔	No comment made

Question 7: *Would you like to be involved in research like this again?*

A	✔	"I would like to do the money course again"
F	✔	"I want to do the course again, or another one using a computer"
I	✔	"I like it"
M	✔	"I enjoyed it"
P	✔	"Go back to the computer"

Question 8: *Would you tell your friends to take this course?*

A	✔	No comment
F	✔	"So they feel good about money too"
I	✔	No comment
M	✔	No comment made
P	✔	No comment made

Question 9: *Have you any additional comments?*

A	No comment
F	"I enjoyed the pictures and music"
I	"I felt good going to money skills"
M	"I thought that it was fun"
P	"I liked the computer and money skills"

Appendix O: Ethics Form

CONSENT FORM

Reason for this project: To see if teaching money skills (eg. giving the right change for a Moro bar in a dairy) using a computer to the intellectually handicapped also means that they are able to use money in the 'real world'.

Your tasks in this project: To spend a couple of hours each week working at a computer and/or going to a store to buy something.

Risks associated with participation: None

Confidentiality: All participants names are changed to help conceal their identity in the research write-up (eg. Fred Jones may be referred to as 'Julian').

Voluntary participation: Yes, but small tokens will be given sometimes (eg. a packet of small chips or a can of juice etc.)

Time Required: Approximately two hours each week (two half hour sessions plus transport time), for about one month. The time may vary depending upon the subjects speed.

Name of researcher/supervisor: *Researcher:* Ms Kirsten Nevill-Manning
Supervisor: Dr Neville Blampied
(University of Canterbury)

I agree to participate in the project described above, on the understanding that if at any time I wish to withdraw from the experiment I may, without prejudice, do so. All information collected will be confidential as will the identity of participants.

Name: _____

Signature: _____ Date: _____

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